0967-066-7010

(FORMERLY NAVSHIPS 93285 (B)
VOLUME 1)

(NON-REGISTERED)

VOLUME 1
TECHNICAL MANUAL
FOR
RADIO SET
AN/URC-32
SERIES

★

DEPARTMENT OF THE NAVY
BUREAU OF SHIPS

NAVSHIPS 0967-066-7010
FORMERLY NAVSHIPS 93285(B)

(Non-Registered)

VOLUME 1

TECHNICAL MANUAL

for

RADIO SET AN/URC-32 SERIES

DEPARTMENT OF THE NAVY
BUREAU OF SHIPS

Approved: 28 May 1963
Published: 1 August 1963
Change 2: 24 August 1966
NAVSHIPS 0967-066-7012

LIST OF EFFECTIVE PAGES

PAGE NUMBERS	CHANGE IN EFFECT	PAGE NUMBERS	CHANGE IN EFFECT
Title Page	Change 2	5-81 to 5-82	Change 2
ii	Change 2	5-83 to 5-84	Original
iii to xiii	Original	5-85 to 5-86	Change 2
1-0 to 1-34	Original	5-87 to 5-96	Original
2-1 to 2-11	Original	5-97 to 5-100	Change 2
3-0 to 3-20	Original	5-101 to 5-104	Original
4-1 to 4-42	Original	5-105 to 5-107	Change 2
4-43 to 4-44	Change 2	5-108 to 5-112	Original
4-45 to 4-58	Original	5-113	Change 2
4-59	Change 2	5-114 to 5-120	Original
4-60 to 4-89	Original	5-121 to 5-122	Change 2
5-0	Change 1	5-123 to 5-127	Original
5-1 to 5-4	Original	5-128 to 5-131	Change 2
5-5 to 5-6	Change 2	5-132	Original
5-6A to 5-6B	Change 2	5-133 to 5-134	Change 2
5-7 to 5-26	Original	6-1 to 6-2	Original
5-27	Change 2	6-3 to 6-4	Change 1
5-28 to 5-41	Original	6-4A to 6-4B	Change 1
5-42 to 5-44	Change 2	6-5 to 6-72	Original
5-45 to 5-64	Original	6-73 to 6-76	Change 2
5-65 to 5-66	Change 2	6-77 to 6-126	Original
5-67 to 5-78	Original	i-1 to i-6	Original
5-79 to 5-80	Change 2		

COLLINS RADIO COMPANY, CEDAR RAPIDS, IOWA,
Contract: NObsr 89170

Errors found in this publication (other than obvious typographical errors), which have not been corrected by means of Temporary Corrections or Permanent Changes should be reported on a User Activity Comment Sheet, NAVSHIPS 4914 (10-62) FSN 0105-503-9850. Such report should include the complete title of the publication and the publication number, identify the page and line or figure and location of the error; and be forwarded to the Publications and Information Retrieval Branch of the Bureau of Ships.

All requests for this publication should be directed to the Naval Supply Depot, 5801 Tabor Avenue, Philadelphia 20, Pennsylvania.

INSTRUCTION SHEET

Change 1 applies to all AN/URC-32 Radio Sets and is in effect immediately upon receipt.

This permanent change revises the technical manual to include the latest Electrical Equipment Maintenance Kit MK-447/URC-32 engineering changes.

1. Make the following pen-and-ink corrections and mark "Ch. 1" adjacent to the pen-and-ink correction.

FIRST ISSUED IN	PAGE NO.	CHANGE IN EFFECT	COL'M OR FIG.	LINE OR LOCATION	ACTION	
Orig	i, vol. 1	Ch. 1		lower right corner	Insert "Change 1: 6 May 1965"	✓
Orig	ii, vol. 1	Ch. 1		list of effective pages	Correct list to indicate Change 1 in effect for pages 5-0, 6-3, 6-4, 6-4A and 6-4B.	✓
Orig	xiii, vol. 1	Ch. 1	2	list of tables	Insert "Table 6-2A. Supplementary Parts List, page 6-3" before table 6-2.	✓
Orig	xiii vol. 1	Ch. 1	2	list of tables	Change page number for table 6-2 from 6-3 to 6-4A.	✓
Orig	i, vol. 3	Ch. 1		lower right corner	Insert "Change 1: 6 May 1965"	✓
Orig	iii, iv vol. 3	Ch. 1	2	list of tables	Insert "Table 6-2A. Supplementary Parts List, page 6-3" before table 6-2.	✓
Orig	iii, iv vol. 3	Ch. 1	2	list of tables	Change page number for table 6-2 from 6-3 to 6-4A.	✓

2. Remove superseded pages and insert revised pages as indicated below:

PAGE	REMOVE	INSERT
4-89/5-0	Orig/Orig	Orig/Ch. 1
6-3/6-4	Orig/Orig	Ch. 1/Ch. 1
6-4A/6-4B	- / -	Ch. 1/Ch. 1

3. Destroy superseded pages after the complete manual has been checked against the List of Effective Pages.

4. Insert this Instruction Sheet just behind the front cover of Volume 1.

INSTRUCTION SHEET

Change 2 applies to all AN/URC-32 Radio Sets and is in effect immediately upon receipt.

This permanent change revises the technical manual to include corrections to errors appearing in the technical manual and the latest engineering changes (change 2 incorporates the information provided by temporary changes T-1, T-2, and T-4).

1. Make the following pen-and-ink corrections and mark "Ch. 2" adjacent to the correction.

FIRST ISSUED IN	PAGE NO.	CH. IN EFFECT	COL'M OR FIG.	LINE OR LOCATION	ACTION
Orig	ix, Vol 1	Ch. 2	Lower right		After figure 5-6, add figure "5-6A. Converter-Oscillator CV-731/URC, 0.1-Kc Tuning Module, Alignment Points . . . . 5-6A."
Orig	xiii, Vol 1	Ch. 2	Lower right		After "6-1. List of Units. ." Add "6-2A. Supplementary Parts List. . . . 6-3." Of "6-2. Maintenance Parts List. . . . 6-3," change 6-3 to 6-4A.
Orig	1-13, Vol 1	Ch. 2	Center right		Change operating temperature to "+75°C (167°F)."
Orig	1-18, Vol 1	Ch. 2	Center right		Of modification beginning "Rerouted primary power to prevent. . . .," in the second sentence, change S12 to P9.
Orig	1-22, Vol 1	Ch. 2	Center right		Of modification, "Revised K1 for grid-block keying," change K1 to K2.
Orig	4-9, Vol 1	Ch. 2	Fig. 4-5	Left column	Mark the unnumbered correction to relay K2, "5."
Orig	5-28, Vol 1	Ch. 2	Fig. 5-25		Add "J8" directly below "MP23" (lower right side). Connect a leader between "J8" and connector J8. Connector J8 is located directly below knob 03.
Orig	5-69, 5-70	Ch. 2	Fig. 5-92		Change "TBF-11" to "TBG-5" and change "TBF-12" to "TBG-6."
Orig	5-75 and 5-76, Vol 1	Ch. 2	Fig. 5-96 (Sheet 1)		Change "R2" to "R3."

FIRST ISSUED IN	PAGE NO.	CH. IN EFFECT	COL'M OR FIG.	LINE OR LOCATION	ACTION
Orig	5-77, 5-78, Vol 1	Ch. 2	Fig. 5-96 (Sheet 2)		Change "R1 680 ohms" to "R4 1800 ohms." Delete jumper between J7 and H14. Delete jumper between J15 and J16. Add jumper between J15 and H14. Add jumper between J7 and H12.
Orig	5-109, and 5-110, Vol 1	Ch. 2	Fig. 5-109		Change "R6 22 ohms" to "R6 5 ohms."
Orig	5-114, Vol 1	Ch. 2	Fig. 5-112		Change "CR1" to "CR7," change "CR6" to "CR1," and change "CR7" to "CR6."
Orig	5-121, Vol 1	Ch. 2	Fig. 5-118		Change "R3 560 ohms" to "R3 1K ohms," and change "R10 560 ohms" to "R10 1K ohms."
Orig	5-124, Vol 1	Ch. 2	Fig. 5-121		Add "- and +" signs to capacitor "C9" so that the + sign is on the side connecting to RT4. Add "- and +" signs to capacitor C10 such that the - sign is on the grounded side. Add "- and +" signs to capacitor C4 such that the - sign is connected to R2.
Orig	5-125, Vol 1	Ch. 2	Fig. 5-122		Show a grounded shield on the connection between J4 pin 7 and S1B pin 5.
Orig	5-126, Vol 1	Ch. 2	Fig. 5-123		Remove capacitors C3 and C4.
Orig	5-127, Vol 1	Ch. 2	Fig. 5-124		Reverse the "- and +" sign on capacitor C3 such that the - sign is connected to pin 12 of switch S1B.
Orig	6-4, Vol 3	Ch. 2	Center of page		Add "1R4 Resistor, fixed, composition: MIL type RC42GF182K."

2. Remove superseded pages and insert revised pages listed as follows:

PAGE	REMOVE	INSERT	PAGE	REMOVE	INSERT
T.P./ii	Orig/Orig	Ch. 2/Ch. 2	5-97/5-98	Orig/Orig	Ch. 2/Ch. 2
4-43/4-44	Orig/Blank	Ch. 2/Blank	5-99/5-100	Orig/Blank	Ch. 2/Blank
4-59/4-60	Orig/Orig	Ch. 2/Orig	5-105/5-106	Orig/Orig	Ch. 2/Ch. 2
5-5/5-6	Orig/Orig	Ch. 2/Ch. 2	5-107/5-108	Orig/Orig	Ch. 2/Orig
5-6A/5-6B	-/-	Ch. 2/Blank	5-113/5-114	Orig/Orig	Ch. 2/Orig
5-27/5-28	Orig/Orig	Ch. 2/Orig	5-121/5-122	Orig/Orig	Ch. 2/Ch. 2
5-41/5-42	Orig/Orig	Orig/Ch. 2	5-127/5-128	Orig/Orig	Orig/Ch. 2
5-43/5-44	Orig/Orig	Ch. 2/Ch. 2	5-129/5-130	Orig/Blank	Ch. 2/Blank
5-65/5-66	Orig/Blank	Ch. 2/Blank	5-131/5-132	Orig/Orig	Ch. 2/Orig
5-79/5-80	Orig/Blank	Ch. 2/Blank	5-133/5-134	Orig/Blank	Ch. 2/Blank
5-81/5-82	Orig/Orig	Ch. 2/Ch. 2	6-73/6-74	Orig/Orig	Ch. 2/Ch. 2
5-85/5-86	Orig/Blank	Ch. 2/Blank	6-75/6-76	Orig/Orig	Ch. 2/Ch. 2

3. Destroy superseded pages after the complete manual has been checked against the List of Effective Pages.

4. Insert this Instruction Sheet just behind the front cover of Volume 1.

LIST OF EFFECTIVE PAGES

PAGE NUMBERS	CHANGE IN EFFECT	PAGE NUMBERS	CHANGE IN EFFECT
Title Page	Original	4-1 to 4-89	Original
ii to xiii	Original	5-0 to 5-134	Original
1-0 to 1-34	Original	6-1 to 6-126	Original
2-1 to 2-11	Original	i-1 to i-6	Original
3-0 to 3-20	Original	5-0	CHANGE 1
		6-3	CHANGE 1
		6-4	CHANGE 1
		6-4A	CHANGE 1
		6-4B	CHANGE 1

COLLINS RADIO COMPANY, CEDAR RAPIDS, IOWA,
Contract: Nobsr 89158

Errors found in this publication (other than obvious typographical errors), which have not been corrected by means of Temporary Corrections or Permanent Changes should be reported on a User Activity Comment Sheet, NAVSHIPS 4914 (10-62) FSN 0105-503-9850. Such report should include the complete title of the publication and the publication number, identify the page and line or figure and location of the error; and be forwarded to the Publications and Information Retrieval Branch of the Bureau of Ships.

All requests for this publication should be directed to the Naval Supply Depot, 5801 Tabor Avenue, Philadelphia 20, Pennsylvania.

TABLE OF CONTENTS

Paragraph Page

SECTION 1 - GENERAL INFORMATION

1-1. Scope . . . 1-1
1-2. General Description . . . 1-1
1-3. Description of Units . . . 1-1
  a. Interconnecting Box J-1007/U . . . 1-1
  b. Radio Frequency Amplifier AM-2061/URT . . . 1-1
  c. Converter-Oscillator CV-731/URC . . . 1-1
  d. Amplifier-Converter-Modulator AM-2064/URC . . . 1-3
  e. Converter-Monitor CV-730/URC . . . 1-4
  f. Amplifier-Control AM-2062( )/URC . . . 1-4
  g. Signal Comparator CM-126/UR . . . 1-5
  h. Control-Power Supply C-2691/URC and Dynamic Handset H-169/U . . . 1-5
  i. Power Supply PP-2154/U . . . 1-6
  j. Electronic Equipment Air Cooler HD-347/U . . . 1-6
  k. Power Supply PP-2153/U . . . 1-7
  l. Electrical Dummy Load DA-218/U . . . 1-7
1-4. Reference Data . . . 1-7
1-5. Equipment Supplied . . . 1-7
1-6. Accessory Equipment . . . 1-7
1-7. Test and Maintenance Equipment Required but not Supplied . . . 1-7
1-8. Factory Changes . . . 1-17
1-9. Field Changes . . . 1-31
1-10. Equipment Similarities . . . 1-31
  a. Radio Sets AN/URC-32 and AN/URC-32A . . . 1-31
  b. Radio Sets AN/URC-32A and AN/URC-32B . . . 1-31
  c. Similarity with Collins Radio Company Transceiver KWT-6 Type 8 . . . 1-31
1-11. Preparation for Reshipment . . . 1-31

SECTION 2 - INSTALLATION

2-1. Unpacking and Handling . . . 2-1
2-2. Power Requirements . . . 2-1
2-3. Site Selection . . . 2-1
2-4. Installation Requirements . . . 2-1
  a. Bureau of Ships Installation . . . 2-1
  b. General . . . 2-1
  c. Electrical Equipment Rack MT-2092/U Installation . . . 2-1
  d. Procedure for Installing Electrical Equipment Installation Kit MK-446A/URC-32 . . . 2-3
  e. Connections to Remote Control Positions . . . 2-4
  f. Connections to Coupler Control C-2698/SRA-22 . . . 2-4
  g. Connections to Coupler Monitor CU-737/URC . . . 2-4

SECTION 2 - INSTALLATION (Cont)

2-4. h. Connections to External 100-Kc Frequency Standard . . . 2-4
  i. Primary Power Connections . . . 2-5
    (1) 115-Volt, 2-Wire Operation . . . 2-5
    (2) 230-Volt, 3-Wire Operation . . . 2-6
    (3) 230-Volt, 2-Wire Operation . . . 2-6
2-5. Cable Assemblies . . . 2-6
2-6. Inspection and Adjustment . . . 2-6
  a. Power Turn-on of Radio Set AN/URC-32( ) . . . 2-6
  b. Adjustments . . . 2-6
    (1) Receiver Gain Adjustment . . . 2-9
    (2) Carrier Reinsert Adjustment . . . 2-9
    (3) CW Keying Release Time Adjustment . . . 2-10
    (4) Independent-Sideband Operation . . . 2-10
      (a) Receive Line Output Gain Adjustments . . . 2-10
      (b) Line Input Gain Adjustments for USB or LSB Transmit Operation . . . 2-10
      (c) Line Input Gain Adjustments for Simultaneous USB and LSB Transmit Operation . . . 2-11
2-7. Interference Reduction . . . 2-11

SECTION 3 - OPERATION

3-1. Functional Operation . . . 3-0
3-2. Operating Procedures . . . 3-0
  a. Description of Controls . . . 3-0
  b. Sequence of Operation . . . 3-5
    (1) Turning On Equipment . . . 3-5
    (2) General Preliminary Settings . . . 3-5
    (3) Selecting Operating Frequency . . . 3-6
    (4) Voice Operation . . . 3-7
    (5) Teletypewriter FSK Operation . . . 3-7
    (6) CW Operation . . . 3-7
  c. Indicator Presentations . . . 3-7
  d. Tuning Procedure and Adjustments . . . 3-8
    (1) Receiver Tuning . . . 3-8
    (2) Transmitter Tuning . . . 3-9
3-3. Summary of Operating Procedures . . . 3-12
3-4. Emergency Operation . . . 3-12
  a. Other Than Normal . . . 3-12
    (1) Damage to Transmitter Section . . . 3-12
    (2) Damage to CW or FSK Functions . . . 3-12
  b. Jamming . . . 3-12
3-5. Operator's Maintenance . . . 3-12
  a. Operating Checks . . . 3-12
    (1) Meter Readings . . . 3-12

TABLE OF CONTENTS (Cont)

Paragraph Page

SECTION 3 - OPERATION (Cont)

3-5. (2) Stabilized Master Oscillator (SMO) Check 3-12
  b. Operating Adjustments 3-12
    (1) Transmit Audio Level Adjustments 3-12
      (a) Voice Operation with Dynamic Handset H-169/U 3-12
      (b) CW and FSK Operation . 3-12
    (2) CW Break-in Adjustment . . 3-12
    (3) Calibration of Radio-Frequency Amplifier AM-2061/URT 3-12
    (4) Frequency Calibration Check of Radio Set AN/URC-32( ) 3-13
      (a) Calibration Check Using Signal Comparator CM-126/UR 3-13
      (b) Calibration Check Using a Transmitted Frequency Standard . . . 3-13
  c. Preventive Maintenance 3-13
  d. Emergency Maintenance 3-13
    (1) Procedure for Simple Repair 3-13

SECTION 4 - TROUBLE SHOOTING

4-1. Logical Trouble Shooting 4-1
  a. Symptom Recognition 4-1
  b. Symptom Elaboration 4-1
  c. Listing Probable Faulty Functions 4-1
  d. Localizing the Faulty Function . . 4-1
  e. Localizing Trouble to the Circuit 4-1
  f. Failure Analysis 4-1
4-2. Over-all Functional Description . . . 4-1
  a. Transmit Signals 4-2
  b. Receive Signals 4-5
  c. Control Circuits 4-5
  d. Power Supply 4-6
4-3. Functional Section Descriptions . . . 4-6
  a. Interconnecting Box J-1007/U . . 4-6
    (1) Functional Test Data 4-6
      (a) Determining Over-all Performance 4-6
      (b) Equipment and Tools Required for Functional Testing 4-6
      (c) Adjustments and Alignments 4-6
    (2) Detailed Circuit Description . 4-6
  b. Radio Frequency Amplifier AM-2061/URT 4-9
    (1) Functional Test Data 4-9
      (a) Determining Over-all Performance 4-9
        1. Time-Delay Circuits 4-9

Paragraph Page

SECTION 4 - TROUBLE SHOOTING (Cont)

4-3. 2. Plate 1 and Plate 2 Balance 4-9
        3. Power Amplifier Filament Voltage . 4-9
      (b) Equipment and Tools Required for Functional Testing 4-9
      (c) Adjustments and Alignments 4-9
    (2) Detailed Circuit Description . 4-9
      (a) Driver Stage 4-9
      (b) Power Amplifier Stage . 4-9
      (c) TGC Circuit 4-10
      (d) ALC Circuit 4-10
      (e) Bias and Filament Circuits 4-10
      (f) Grid Block Keying . . . 4-10
      (g) Switch and Interlock Circuits 4-10
  c. Converter-Oscillator CV-731/URC 4-13
    (1) Functional Test Data 4-19
      (a) Determining Over-all Performance 4-19
        1. Stabilized Master Oscillator (SMO) Model C 4-19
        2. Sidestep Oscillator Operation 4-19
        3. R-F Tuner Operation 4-19
        4. Calibration Checks . 4-19
        5. Trouble Isolation . . 4-20
      (b) Equipment and Tools Required for Functional Testing 4-20
      (c) Adjustments and Alignments 4-20
    (2) Detailed Circuit Description . 4-20
      (a) R-F Tuner Module . . . 4-20
      (b) R-F Tuner Module, Transmit Function . . 4-20
      (c) R-F Tuner Module, Receive Function . . . 4-38
      (d) Stabilized Master Oscillator Module . . . 4-38
      (e) Stabilized Master Oscillator, Model A and Model B 4-38
      (f) Stabilized Master Oscillator, Model C . . 4-39
      (g) Master Oscillator Subassembly 4-39
      (h) Master Oscillator (Model B and Model C SMO Modules) 4-39
      (i) R-F Tuner Subassembly 4-39
      (j) I-F Mixers Subassembly 4-40

TABLE OF CONTENTS (Cont)

Paragraph Page

SECTION 4 - TROUBLE SHOOTING (Cont)

4-3. (k) Interpolation Oscillator Subassembly 4-40
(l) Signal I-F Amplifier Subassembly for Stabilized Master Oscillator, Model A 4-45
(m) Signal I-F Amplifier for Stabilized Master Oscillator, Model B and Model C 4-50
(n) 4-Kc Spectrum Generator Subassembly 4-51
(o) Reference I-F Amplifier Subassembly 4-52
(p) AFC Meter Amplifier . . 4-52
(q) Sidestep Oscillator Module 4-55
(r) Frequency Divider Module 4-55
1. Input Amplifier . . . 4-55
2. 20-Kc Divider . . . 4-55
3. 4-Kc Divider 4-56
4. 1-Kc Divider 4-56
(s) Reference Oscillator Module 4-56
1. Crystal Oscillator and Regenerative Dividers 4-56
2. Oven Control Circuit 4-57
(t) Accessory Isolation Amplifier Module (AM-1785/GRC) . . . 4-58
1. 100-Kc Amplifier . . 4-58
2. Multipliers 4-58
(u) 0.1-Kc Tuning Module . 4-58
(v) 0.1-Kc Tuning Module, Transmit Function . . 4-59
(w) 0.1-Kc Tuning Module, Receive Function . . . 4-59
(x) Chassis Circuits 4-59
d. Amplifier-Converter Modulator AM-2064/URC 4-59
(1) Functional Test Data 4-60
(a) Determining Over-all Performance 4-60
(b) Equipment and Tools Required for Functional Testing 4-60
(c) Adjustments and Alignments 4-60
(2) Detailed Circuit Description . 4-63
(a) Balanced Modulator Module 4-63
(b) Carrier Generator Module 4-63
(c) TGC Module 4-64

Paragraph Page

SECTION 4 - TROUBLE SHOOTING (Cont)

4-3. (d) LSB I-F/A-F Amplifier Module 4-64
(e) USB I-F/A-F Amplifier Module 4-67
(f) AM I-F/A-F Amplifier Module 4-67
(g) TGC-VOX Anti-VOX Module (Not Supplied with AN/URC-32( )) . . 4-67
(h) Chassis Circuits 4-67
e. Converter-Monitor CV-730/URC . 4-67
(1) Functional Test Data 4-68
(a) Determining Over-all Performance 4-68
(b) Equipment and Tools Required for Functional Testing 4-68
(c) Adjustments and Alignments 4-68
(2) Detailed Circuit Description . 4-68
(a) Oscillator V1A 4-69
(b) Buffer and Output Amplifier 4-69
(c) CW Break-in Relay Circuit 4-70
(d) BFO Circuit 4-70
f. Amplifier-Control AM-2062/URC and AM-2062A/URC 4-70
(1) Functional Test Data 4-73
(a) Determining Over-all Performance 4-73
(b) Equipment and Tools Required for Functional Testing 4-76
(c) Adjustments and Alignments 4-76
(2) Detailed Circuit Description . 4-76
(a) Upper-Sideband Line Amplifier A1 356C-1 . 4-76
(b) Lower-Sideband Line Amplifier A2 356C-1 . 4-76
(c) Microphone Amplifier A3 356C-1 4-76
(d) Speaker Amplifier A4 356D-1 4-76
(e) Upper-Sideband Amplifier AM-3198/URC 4-76
(f) Lower-Sideband Line Amplifier A2 AM-3198/URC 4-79
(g) Speaker Amplifier A3 356D-1 4-79
g. Signal Comparator CM-126/UR . 4-79
(1) Functional Test Data 4-79
(a) Determining Over-all Performance 4-79

TABLE OF CONTENTS (Cont)

Paragraph Page

SECTION 4 - TROUBLE SHOOTING (Cont)

4-3. 1. Operating Procedure Using 100-Kc External Frequency Standard 4-79
2. Operating Procedure Using a Transmitted Frequency Standard 4-79
(b) Equipment Required for Functional Testing . . 4-80
(c) Adjustment and Alignments 4-80
(2) Detailed Circuit Description . 4-80
h. Control-Power Supply C-2691/URC 4-80
(1) Functional Test Data 4-80
(a) Determining Over-all Performance 4-80
(b) Equipment Required for Functional Testing . . 4-80
(c) Adjustments and Alignments 4-80
(2) Detailed Circuit Description . 4-80
i. Dynamic Handset H-169/U and Cord CX-1846A/U 4-83
(1) Functional Test Data 4-83
(2) Detailed Circuit Description . 4-83
j. Power Supply PP-2154/U 4-83
(1) Functional Test Data 4-83
(a) Determining Over-all Performance 4-83
(b) Equipment Required for Functional Testing . . 4-83
(c) Adjustments and Alignments 4-83
(2) Detailed Circuit Description . 4-83
k. Electronic Equipment Air Cooler HD-347/U 4-83
l. Power Supply PP-2153/U 4-83
(1) Functional Test Data 4-83
(a) Determining Over-all Performance 4-84
(b) Equipment Required for Functional Testing . . 4-84
(c) Adjustments and Alignments 4-84
(2) Detailed Circuit Description . 4-84
4-4. Checkout Procedure for Radio Set AN/URC-32( ) and Antenna Coupler Group AN/SRA-22 4-84
a. General 4-84
b. Initial Setting of Front Panel Controls 4-84
c. Blower Interlock Switch 4-87
d. Low-Voltage Measurement . . . 4-87
e. Frequency Accuracy Check of Reference Oscillator and SMO . 4-87

Paragraph Page

SECTION 4 - TROUBLE SHOOTING (Cont)

4-4. f. Converter-Monitor CV-730/URC Unit Check 4-88
g. Radio Frequency Amplifier AM-2061/URT Unit Check . . . 4-88
h. R-F Tuner Module Gain Check . . 4-88
i. Sidestep Oscillator Check 4-88
j. Over-all Transmit Operation Check 4-89
k. Receiver Sensitivity Check . . . 4-89
l. Antenna Coupler Group AN/SRA-22 Check 4-89
m. Coupler Monitor CU-737/URC Check 4-89

SECTION 5 - MAINTENANCE

5-1. Failure and Performance and Operational Reports 5-0
5-2. Preventive Maintenance 5-0
a. Maintenance Standards 5-0
b. Alignment and Adjustment 5-0
(1) Radio Frequency Amplifier AM-2061/URT 5-1
(a) Bias Voltage Adjustment 5-1
(b) Neutralization Adjustment 5-1
(c) Power Amplifier Tube Balance 5-1
(d) ALC Adjustment 5-1
(e) Power Amplifier Filament Voltage Check 5-2
(2) Converter-Oscillator CV-731/URC 5-2
(a) R-F Tuner Module Alignment 5-2
1. R-F and I-F Circuit Alignment, Transmit Function 5-2
2. R-F and I-F Circuit Alignment, Receive Function 5-3
(b) Reference Oscillator Module Alignment . . . 5-3
(c) Sidestep Oscillator Module Alignment . . . 5-5
(d) 0.1-Kc Tuning Module Alignment 5-5
(e) Stabilized Master Oscillator Module Alignment 5-6
1. Interpolation Oscillator and Master Oscillator . 5-6
2. R-F Tuner Subassembly Alignment 5-6

TABLE OF CONTENTS (Cont)

Paragraph Page

SECTION 5 - MAINTENANCE (Cont)

5-2.
- 3. I-F Mixers Subassembly Alignment (Model A and Model B SMO) 5-6
- 4. I-F Mixer Subassembly Alignment (Model C SMO) . . 5-7
- 5. 4-Kc Spectrum Generator Alignment . 5-7
- 6. Reference I-F Amplifier Subassembly Alignment 5-7
- 7. Signal I-F Amplifier Subassembly Alignment (Model A SMO) 5-7
- 8. Signal I-F Amplifier Subassembly Alignment (Model B and Model C SMO) . . . 5-8
- 9. AFC Meter Amplifier Subassembly Meter Balance Adjustment (Model B and Model C SMO) 5-9
- 10. Replacement Alignment Procedure for Stabilized Master Oscillator 5-9
- (f) Isolation Amplifier Module (AM-1785/GRC) Alignment 5-10
- (3) Amplifier-Converter-Modulator AM-2064/URC 5-10
  - (a) Carrier Generator Module Alignment 5-11
  - (b) Carrier Balance Adjustment of Balanced Modulator Module 5-11
  - (c) USB I-F/A-F Amplifier Module Alignment . . . 5-11
  - (d) LSB I-F/A-F Amplifier Module Alignment . . . 5-12
  - (e) AM I-F/A-F Amplifier Module Alignment . . . 5-12
  - (f) Carrier Reinsert Adjustment 5-12
  - (g) Meter Balance Adjustment 5-12
  - (h) LSB and USB Audio Gain Adjustments 5-12
  - (i) TGC Amplifier Module Alignment 5-13
- (4) Converter-Monitor CV-730/URC 5-13
  - (a) CW Keying Release Time Adjustment 5-13

Paragraph Page

SECTION 5 - MAINTENANCE (Cont)

5-2.
  - (b) FSK Frequency Adjustment 5-13
  - (c) BFO Frequency Adjustment 5-14
- (5) Amplifier-Control AM-2062/URC and AM-2062A/URC . 5-14
  - (a) Line Level Adjustments (AM-2062/URC and AM-2062A/URC) 5-14
  - (b) Speaker Amplifier Module Gain Adjustment (AM-2062/URC and AM-2062A/URC) . . . 5-14
  - (c) Mike and Line Amplifier Module Gain Adjustment (AM-2062/URC Unit Only) 5-14

5-3. Repair 5-14
- a. Removal, Repair, and Replacement of Parts, Modules, and Units 5-14
  - (1) Interconnecting Box J-1007/U 5-14
    - (a) Removal 5-14
    - (b) Disassembly 5-15
    - (c) Assembly and Replacement 5-15
  - (2) Radio Frequency Amplifier AM-2061/URT 5-15
    - (a) Removal 5-15
    - (b) Disassembly 5-15
      - 1. Front and Rear Panels from Chassis 5-15
    - (c) Assembly and Replacement 5-15
  - (3) Converter-Oscillator CV-781/URC 5-15
    - (a) Unit Removal 5-15
    - (b) Removing SMO Module . 5-15
    - (c) Removing R-F Tuner Module 5-15
    - (d) Removing the Remaining Modules from Converter-Oscillator CV-731/URC 5-15
    - (e) Removing SMO Subassemblies 5-17
    - (f) Replacing SMO Subassemblies 5-19
      - 1. Master Oscillator . . 5-19
      - 2. Interpolation Oscillator 5-19
      - 3. I-F Mixer, Signal I-F Amplifier, and 4-Kc Spectrum Generator 5-20
      - 4. Testing SMO 5-20
    - (g) Replacing Front Panel 5-20

TABLE OF CONTENTS (Cont)

Paragraph Page

SECTION 5 - MAINTENANCE (Cont)

5-3. (h) Replacement of Converter-Oscillator Modules 5-20
  1. Replacement of R-F Tuner Module . . . 5-20
  2. Replacement of SMO Module 5-20
  (i) Replacement of Converter-Oscillator CV-731/URC 5-21
 (4) Amplifier-Converter-Modulator AM-2064/URC 5-21
  (a) Removal 5-21
  (b) Removing Modules from Amplifier-Converter-Modulator AM-2064/URC 5-21
  (c) Replacement 5-21
 (5) Converter-Monitor CV-730/URC 5-21
  (a) Removal 5-21
  (b) Replacement 5-23
 (6) Amplifier-Control AM-2062/URC and AM-2062A/URC . 5-23
  (a) Removal 5-23
  (b) Removing Modules from Amplifier-Control AM-2062/URC or AM-2062A/URC . . . 5-23
  (c) Replacement 5-23
 (7) Signal Comparator CM-126/UR 5-23
  (a) Removal 5-23
  (b) Replacement 5-23

Paragraph Page

SECTION 5 - MAINTENANCE (Cont)

5-3. (8) Power Supply PP-2153/U . . 5-23
  (a) Removal 5-23
  (b) Replacement 5-24
 (9) Control-Power Supply C-2691/URC 5-24
  (a) Removal 5-24
  (b) Replacement 5-24
 (10) Power Supply PP-2154/U . . 5-24
  (a) Removal 5-24
  (b) Replacement 5-24
 (11) Electronic Equipment Air Cooler HD-347/U 5-24
  (a) Removal 5-24
  (b) Air Filter Cleaning Procedure 5-24
  (c) Lubrication 5-24
  (d) Replacement 5-24
 b. Emergency Maintenance for Electronic Assemblies 5-24
5-4. Schematic Diagrams and Test Data 5-24

SECTION 6 - PARTS LIST

6-1. Introduction 6-1
 a. Reference Designations 6-1
 b. Ref Desig Prefix 6-1
6-2. List of Units 6-1
6-3. Maintenance Parts List 6-1
6-4. List of Manufacturers 6-2
6-5. Stock Number Identification 6-2
6-6. Notes 6-2

LIST OF ILLUSTRATIONS

Figure Page

SECTION 1 - GENERAL INFORMATION

1-1. Radio Set AN/URC-32( ) (AN/URC-32B Version) 1-0
1-2. Radio Frequency Amplifier AM-2061/URT 1-2
1-3. Converter-Oscillator CV-731/URC (AN/URC-32B Version) 1-3
1-4. Amplifier-Converter-Modulator AM-2064/URC 1-4
1-5. Converter-Monitor CV-730/URC 1-4
1-6. Amplifier-Control AM-2062A/URC (AN/URC-32A and AN/URC-32B Version) 1-5

Figure Page

SECTION 1 - GENERAL INFORMATION (Cont)

1-7. Signal Comparator CM-126/UR . . . 1-5
1-8. Control-Power Supply C-2691/URC 1-6
1-9. Dynamic Handset H-169/U and Cord Assembly CX-1846A/U . . . 1-6
1-10. Power Supply PP-2154/U 1-6
1-11. Electronic Equipment Air Cooler HD-347/U 1-7
1-12. Power Supply PP-2153/U 1-8
1-13. Electrical Dummy Load DA-218/U 1-8
1-14. Radio Set AN/URC-32( ), Rear View 1-9

LIST OF ILLUSTRATIONS (Cont)

Figure Page

SECTION 2 - INSTALLATION

2-1. Rack Mounting of Electronic Equipment Air Cooler HD-347/U 2-2
2-2. Base Shockmount Installation 2-2
2-3. Location of Power Supply PP-2153/U Bulkhead Mounting Terminal Box 2-3
2-4. Mounting Location of Electrical Dummy Load DA-218/U 2-4
2-5. Typical Installations for Radio Set AN/URC-32( ), Showing Mounting and Clearance Dimensions 2-5
2-6. Basic Installation for Radio Set AN/URC-32( ), Showing Outline and Mounting Dimensions 2-7
2-7. Flush Mounting Installation for Radio Set AN/URC-32( ), Showing Outline and Mounting Dimensions 2-8
2-8. Fabrication of RG-8/U Coaxial Cable and Connector 2-9

SECTION 3 - OPERATION

3-1. Radio Set AN/URC-32( ), Operating Controls and Indicators 3-6
3-2. Calibration Curve for DRIVER TUNE Control on AM-2061/URT 3-10
3-3. Calibration Curve for PA TUNE Control on AM-2061/URT 3-11

SECTION 4 - TROUBLE SHOOTING

4-1. Radio Set AN/URC-32( ), Over-all Functional Block Diagram 4-2
4-2. Radio Set AN/URC-32( ), Transmit Circuit, Functional Block Diagram . 4-3
4-3. Radio Set AN/URC-32( ), Receive Circuit, Functional Block Diagram . 4-5
4-4. Radio Set AN/URC-32( ), Control Circuits, Functional Block Diagram 4-7
4-5. Thermal Relay Input Protector, Simplified Schematic Diagram . . . 4-9
4-6. Radio Frequency Amplifier AM-2061/URT, Servicing Block Diagram 4-11
4-7. Drive Tuning Calibration Curve for AM-2061/URT 4-13
4-8. Neutralizing Circuit for AM-2061/URT 4-14
4-9. Plate Tuning Calibration Curve for AM-2061/URT 4-15
4-10. Converter-Oscillator CV-731/URC, Functional Block Diagram 4-17
4-11. Converter-Oscillator CV-731/URC, Servicing Block Diagram 4-41
4-12. Frequency Discriminator, Response Curve Derivation 4-46

SECTION 4 - TROUBLE SHOOTING (Cont)

4-13. Model A Phase and Frequency Discriminator, Simplified Schematic Diagram 4-46
4-14. Curve of Saturable Control of Master Oscillator Frequency . . . 4-47
4-15. Phase and Frequency Discriminator, Equivalent Circuit 4-48
4-16. Discriminator Tuned Circuits, Frequency Versus Reactance Curves 4-48
4-17. Model B Phase Discriminator, Vector Diagrams 4-51
4-18. Model B and Model C Phase and Frequency Discriminator, Simplified Schematic Diagram . . . 4-53
4-19. 20-Kc Divider, Simplified Schematic Diagram 4-56
4-20. 20-Kc Divider, Base Voltage Waveforms 4-57
4-21. Amplifier-Converter-Modulator AM-2064/URC, Servicing Block Diagram 4-65
4-22. Converter-Monitor CV-730/URC, Servicing Block Diagram 4-71
4-23. Amplifier-Control AM-2062/URC or AM-2062A/URC, Functional Block Diagram 4-72
4-24. Amplifier-Control AM-2062A/URC, Servicing Block Diagram 4-77
4-25. Signal Comparator CM-126/UR, Servicing Block Diagram 4-78
4-26. Control-Power Supply C-2691/URC, Servicing Block Diagram 4-81
4-27. Power Supply PP-2154/U, Servicing Block Diagram 4-82
4-28. Power Supply PP-2153/U, Servicing Block Diagram 4-85

SECTION 5 - MAINTENANCE

5-1. Electrical Equipment Maintenance Kit MK-447/URC-32 5-0
5-2. Typical Application of Module Tray and Extension Cable 5-2
5-3. Typical Application of SMO Subassembly Extension Board 5-3
5-4. Coverter-Oscillator CV-731/URC, R-F Tuner Module, Alignment Points 5-4
5-5. Converter-Oscillator CV-731/URC, Reference Oscillator Module, Alignment Points 5-5
5-6. Converter-Oscillator CV-731/URC, Sidestep Oscillator Module, Alignment Points 5-5
5-6A CONVERTER-OSCILLATOR CV-731/URC 0.1KC TUNING MODULE, ALIGNMENT POINTS 5-6A

LIST OF ILLUSTRATIONS (Cont)

Figure Page

SECTION 5 - MAINTENANCE (Cont)

5-7. Converter-Oscillator CV-731/URC, SMO Module, Reference I-F Amplifier 5-7
5-8. Converter-Oscillator CV-731/URC, SMO Module Alignment Points and Subassembly Location 5-9
5-9. Amplifier-Converter-Modulator AM-2064/URC, Test Point Location 5-11
5-10. Amplifier-Converter-Modulator AM-2064/URC, Chassis, Front View 5-12
5-11. Converter-Monitor CV-730/URC, Front View with Cover Removed . . 5-13
5-12. Radio Frequency Amplifier AM-2061/URT Front and Rear Views (AN/URC-32A and AN/URC-32B Version) 5-16
5-13. Converter-Oscillator CV-731/URC, Module Location (AN/URC-32B Version) 5-17
5-14. Converter-Oscillator CV-731/URC, SMO Module, Subassemblies Removed 5-18
5-15. Converter-Oscillator CV-731/URC, SMO Module, Front and Top Views . 5-19
5-16. Converter-Oscillator CV-731/URC, Frequency Change Drive Adjustments 5-21
5-17. Amplifier-Converter-Modulator AM-2064/URC, Module Location . . 5-22
5-18. Amplifier-Control AM-2062/URC, Module Location (AN/URC-32 Version) 5-22
5-19. Amplifier-Control AM-2062A/URC, Module Location (AN/URC-32A and AN/URC-32B Version) 5-23
5-20. Interconnecting Box J-1007/U, Thermal Relay Input Protector, Bottom View, Cover Removed . . . 5-25
5-21. Radio Frequency Amplifier AM-2061/URT, Front Panel, Rear View 5-26
5-22. Radio Frequency Amplifier AM-2061/URT, Front View, Front Panel Removed 5-26
5-23. Radio Frequency Amplifier AM-2061/URT, Rear View, Cover Removed 5-27
5-24. Converter-Oscillator CV-731/URC, Rear View with Cover Removed 5-27
5-25. Converter-Oscillator CV-731/URC, Front View with Cover Removed 5-28
5-26. Converter-Oscillator CV-731/URC, R-F Tuner Module, Rear View, Right Side Oblique View 5-29

Figure Page

SECTION 5 - MAINTENANCE (Cont)

5-27. Converter-Oscillator CV-731/URC, R-F Tuner Module, Rear View, Left Side Oblique View 5-30
5-28. Converter-Oscillator CV-731/URC, R-F Tuner Module, Front View . . 5-31
5-29. Converter-Oscillator CV-731/URC, R-F Tuner Module, Model B, Front View 5-32
5-30. Converter-Oscillator CV-731/URC, Reference Oscillator Module, Right Side Oblique View 5-33
5-31. Converter-Oscillator CV-731/URC, Reference Oscillator Module, Left Side Oblique View 5-34
5-32. Converter-Oscillator CV-731/URC, Sidestep Oscillator Module, Right Side Oblique View 5-34
5-33. Converter-Oscillator CV-731/URC, Sidestep Oscillator Module, Left Side Oblique View 5-35
5-34. Converter-Oscillator CV-731/URC, Frequency Divider Module, Right Side Oblique View 5-35
5-35. Converter-Oscillator CV-731/URC, Frequency Divider Module, Left Side Oblique View 5-35
5-36. Converter-Oscillator CV-731/URC, SMO Module, Model A, Master Oscillator Assembly 5-36
5-37. Converter-Oscillator CV-731/URC, SMO Module, Model B 5-37
5-38. Converter-Oscillator CV-731/URC, SMO Module, I-F Mixer Assembly . 5-38
5-39. Converter-Oscillator CV-731/URC, SMO Module, 4-Kc Spectrum Generator Assembly 5-38
5-40. Converter-Oscillator CV-731/URC, SMO Module, Model A, Signal I-F Amplifier 5-39
5-41. Converter-Oscillator CV-731/URC, SMO Module, Model B, I-F Amplifier Assembly 5-39
5-42. Converter-Oscillator CV-731/URC, SMO Module, Model B and C, Meter Amplifier Assembly 5-40
5-43. Converter-Oscillator CV-731/URC, Isolation Amplifier Module, Alignment Points 5-40
5-44. Converter-Oscillator CV-731/URC, Isolation Amplifier Module 5-40
5-45. Converter-Oscillator CV-731/URC, SMO Module, Model C, I-F Mixer Assembly 5-41

LIST OF ILLUSTRATIONS (Cont)

Figure Page

SECTION 5 - MAINTENANCE (Cont)

5-46. Converter-Oscillator CV-731/URC, 0.1-Kc Tuning Module, Side View, Left Cover Removed (Used on AN/URC-32B Equipment Only) . . . 5-42
5-47. Converter-Oscillator CV-731/URC, 0.1-Kc Tuning Module, Side View, Left Cover and Crystal Unit Removed (Used on AN/URC-32B Equipment Only) 5-43
5-48. Converter-Oscillator CV-731/URC, 0.1-Kc Tuning Module, Side View, Right Cover Removed (Used on AN/URC-32B Equipment Only) . . . 5-44
5-49. Amplifier-Converter-Modulator AM-2064/URC, Chassis, Rear View 5-45
5-50. Amplifier-Converter-Modulator AM-2064/URC, Chassis, Rear View, Cover Removed 5-45
5-51. Amplifier-Converter-Modulator AM-2064/URC, LSB I-F/A-F Amplifier Module and USB I-F/A-F Amplifier Module, Front View with Cover Removed 5-46
5-52. Amplifier-Converter-Modulator AM-2064/URC, LSB I-F/A-F Amplifier Module and USB I-F/A-F Amplifier Module, Rear View with Cover Removed 5-46
5-53. Amplifier-Converter-Modulator AM-2064/URC, AM I-F/A-F Amplifier Module, Front View, Cover Removed 5-47
5-54. Amplifier-Converter-Modulator AM-2064/URC, AM I-F/A-F Amplifier Module, Rear View, Cover Removed 5-48
5-55. Amplifier-Converter-Modulator AM-2064/URC, Carrier Generator Module, Front View, Cover Removed 5-48
5-56. Amplifier-Converter-Modulator AM-2064/URC, Carrier Generator Module, Rear View, Cover Removed 5-49
5-57. Amplifier-Converter-Modulator AM-2064/URC, Balanced Modulator Module, USB Modulator Assembly A1, Cover Removed 5-49
5-58. Amplifier-Converter-Modulator AM-2064/URC, Balanced Modulator Module, LSB Modulator Assembly A2, Cover Removed 5-49
5-59. Amplifier-Converter-Modulator AM-2064/URC, TGC Module,and TGC-VOX Anti-VOX Module, TGC Assembly, Cover Removed (For Information Only, Not Supplied with AN/URC-32( )) 5-50

Figure Page

SECTION 5 - MAINTENANCE (Cont)

5-60. Amplifier-Converter-Modulator AM-2064/URC, TGC-VOX Anti-VOX Module, VOX Anti-VOX Assembly, Cover Removed (For Information Only, Not Supplied with AN/URC-32( )) 5-50
5-61. Amplifier-Converter-Modulator AM-2064/URC, Balanced Modulator Dummy Plug, Cover Removed (For Information Only, Not Supplied with AN/URC-32( )) 5-50
5-62. Converter-Monitor CV-730/URC, BFO Subassembly A1, Cover Removed 5-50
5-63. Converter-Monitor CV-730/URC, Rear View with Cover Removed . . 5-51
5-64. Amplifier-Control AM-2062/URC, Chassis, Front View, Cover Removed 5-51
5-65. Amplifier-Control AM-2062/URC, Chassis, Rear View, Cover Removed 5-52
5-66. Amplifier-Control AM-2062/URC, Mike or Line Amplifier Module, Component Side, Cover Removed . . 5-52
5-67. Amplifier-Control AM-2062/URC, Mike or Line Amplifier Module, Wiring Side, Cover Removed . . . 5-52
5-68. Amplifier-Control AM-2062/URC, Speaker Amplifier Module, Component Side, Cover Removed . . 5-53
5-69. Amplifier-Control AM-2062/URC, Speaker Amplifier Module, Wiring Side, Cover Removed 5-53
5-70. Amplifier-Control AM-2062A/URC, Chassis, Front View, Cover Removed 5-54
5-71. Amplifier-Control AM-2062A/URC, Chassis, Rear View, Cover Removed 5-54
5-72. Amplifier-Control AM-2062A/URC, Line Amplifier Module, Top View, Cover Removed 5-55
5-73. Amplifier-Control AM-2062A/URC, Line Amplifier Module, Bottom View, Cover Removed 5-56
5-74. Amplifier-Control AM-2062A/URC, Speaker Amplifier Module, Component Side, Cover Removed 5-57
5-75. Amplifier-Control AM-2062A/URC, Speaker Amplifier Module, Wiring Side, Cover Removed 5-57
5-76. Signal Comparator CM-126/UR, Front View with Cover Removed . . 5-58
5-77. Signal Comparator CM-126/UR, Rear View with Cover Removed . . 5-58

LIST OF ILLUSTRATIONS (Cont)

Figure Page

SECTION 5 - MAINTENANCE (Cont)

5-78. Power Supply PP-2153/U, Rear View 5-58
5-79. Power Supply PP-2153/U, Front View, Cover Removed 5-59
5-80. Control-Power Supply C-2691/URC, Front View with Cover Removed . . 5-59
5-81. Control-Power Supply C-2691/URC, Rear View with Cover Removed . . 5-60
5-82. Power Supply PP-2154/U, Front View with Cover Removed 5-60
5-83. Power Supply PP-2154/U, Rear View 5-60
5-84. Power Supply PP-2154/U, Rear View with Cover Removed 5-61
5-85. Electronic Equipment Air Cooler HD-347/U, Front Cover and Filter Removed 5-61
5-86. Dynamic Handset H-169/U and Cord CX-1846A/U 5-62
5-87. Electrical Dummy Load DA-218/U with Cover Removed 5-62
5-88. Radio Set AN/URC-32( ), Coaxial Interunit Connections Diagram . . . 5-63
5-89. Radio Set AN/URC-32( ), Primary Power Distribution Schematic Diagram 5-65
5-90. Radio Set AN/URC-32( ), Transmit Control Circuit Schematic Diagram 5-67
5-91. Radio Set AN/URC-32( ), Power Supply PP-2153/U, Bulkhead Mounting Cable Diagram 5-68
5-92. Radio Set AN/URC-32( ), External Connections to Remote Control Units 5-69
5-93. Radio Set AN/URC-32( ), External Connections to Antenna Control C-1360( )/SRT (Part of AN/BRA-3) and Coupler Monitor CU-737/URC . 5-71
5-94. Radio Set AN/URC-32( ), External Connections to Antenna Coupler Group AN/SRA-22 5-72
5-95. External Connections and Modifications for Alternate Use of Radio Set AN/URC-32( ) with Coupler Monitor CU-737/URC and Multicoupler . . . 5-73
5-96. Interconnecting Box J-1007/U, Interconnecting Wiring Diagram 5-75
5-97. Interconnecting Box J-1007/U, Thermal Relay Input Protector, Schematic Diagram 5-79
5-98. Radio Frequency Amplifier AM-2061/URT, MCN No. 1833 and Below, Schematic Diagram 5-81
5-99. Radio Frequency Amplifier AM-2061/URT, MCN No. 1834 and Above, Schematic Diagram 5-82
5-100. Radio Frequency Amplifier AM-2061/URT, Alignment Test Setup 5-83

Figure Page

SECTION 5 - MAINTENANCE (Cont)

5-101. Converter-Oscillator CV-731/URC, Schematic Diagram (0.1-Kc Tuning Module Included) 5-85
5-102. Converter-Oscillator CV-731/URC, R-F Tuner Module, Model A, Schematic Diagram 5-87
5-103. Converter-Oscillator CV-731/URC, R-F Tuner Module, Model B, Schematic Diagram 5-91
5-104. Converter-Oscillator CV-731/URC, Sidestep Oscillator Module, Schematic Diagram 5-95
5-105. Converter-Oscillator CV-731/URC, Stabilized Master Oscillator Module (SMO), Model A, Schematic Diagram 5-97
5-106. Converter-Oscillator CV-731/URC, Stabilized Master Oscillator (SMO), Model B, Schematic Diagram . . . 5-101
5-107. Converter-Oscillator CV-731/URC, Stabilized Master Oscillator (SMO), Model C, Schematic Diagram . . . 5-105
5-108. Converter-Oscillator CV-731/URC, Frequency Divider Module, Schematic Diagram 5-108
5-109. Converter-Oscillator CV-731/URC, Reference Oscillator Module, Schematic Diagram 5-109
5-110. Converter-Oscillator CV-731/URC, Isolation Amplifier Module, Schematic Diagram 5-111
5-111. Converter-Oscillator CV-731/URC, 0.1-Kc Tuning Module, Schematic Diagram 5-113
5-112. Amplifier-Converter-Modulator AM-2064/URC, Chassis, Schematic Diagram 5-114
5-113. Amplifier-Converter-Modulator AM-2064/URC, Balanced Modulator Module, Schematic Diagram 5-115
5-114. Amplifier-Converter-Modulator AM-2064/URC, Carrier Generator Module, Schematic Diagram 5-116
5-115. Amplifier-Converter-Modulator AM-2064/URC, TGC Module, Schematic Diagram 5-117
5-116. Amplifier-Converter-Modulator AM-2064/URC, LSB and USB I-F/A-F Amplifier Modules, Schematic Diagram 5-119
5-117. Amplifier-Converter-Modulator AM-2064/URC, AM I-F/A-F Amplifier Module, Schematic Diagram 5-120

LIST OF ILLUSTRATIONS (Cont)

Figure Page

SECTION 5 - MAINTENANCE (Cont)

5-118. Amplifier-Converter-Modulator AM-2064/URC, TGC-VOX Anti-VOX Module, Schematic Diagram (For Information Only, Not Normally Supplied with AN/URC-32( )) 5-121
5-119. Converter-Monitor CV-730/URC, Schematic Diagram 5-122
5-120. Amplifier-Control AM-2062/URC, Schematic Diagram 5-123
5-121. Amplifier-Control AM-2062A/URC, Schematic Diagram 5-124
5-122. Signal Comparator CM-126/UR, Schematic Diagram 5-125
5-123. Power Supply PP-2153/U, Schematic Diagram 5-126
5-124. Control-Power Supply C-2691/URC, Schematic Diagram 5-127
5-125. Power Supply PP-2154/U, Schematic Diagram 5-128
5-126. Dynamic Handset H-169/U, Schematic Diagram 5-129
5-127. Electronic Equipment Air Cooler HD-347/U, Schematic Diagram . . 5-129
5-128. Coupler Monitor CU-737/URC, Schematic Diagram 5-131
5-129. Antenna Coupler Group AN/SRA-22, Schematic Diagram 5-132
5-130. Antenna Coupler Group AN/SRA-22, Remote Control Schematic Diagram 5-133

LIST OF TABLES

Table Page

SECTION 1 - GENERAL INFORMATION

1-1. Nomenclature Cross-Reference List . 1-1
1-2. Reference Data for Radio Set AN/URC-32( ) 1-10
1-3. Equipment Supplied for Radio Set AN/URC-32( ) 1-14
1-4. Accessory Equipment 1-15
1-5. Equipment Required But Not Supplied 1-15
1-6. Factory Changes on the AN/URC-32( ) 1-17
1-7. Field Changes on the AN/URC-32( ) . 1-32

SECTION 3 - OPERATION

3-1. Description of Operating Controls and Indicators for Radio Set AN/URC-32( ) 3-0
3-2. Control Settings for Voice Operation . 3-8
3-3. Examples of Selecting CW or FSK Operating Frequencies 3-8
3-4. Normal Meter Readings on Radio Set AN/URC-32( ) During Transmit Operation 3-9
3-5. Operator's Trouble Shooting Procedure 3-14
3-6. Summary of Operating Procedures for Radio Set AN/URC-32( ) 3-14

SECTION 4 - TROUBLE SHOOTING

4-1. Trouble Isolation to Module 4-21
4-2. Oscilloscope Waveforms 4-22
4-3. R-F Tuner Module, Signal Levels 4-23
4-4. Stabilized Master Oscillator Trouble Isolation Chart 4-24
4-5. Test Equipment for Functional Testing of CV-731/URC 4-34
4-6. Sideband Generator Module Trouble Isolation Test Point Voltages 4-61
4-7. Test Equipment for Functional Testing of Amplifier-Converter-Modulator AM-2064/URC 4-61
4-8. Test Equipment for Functional Testing of CV-730/URC 4-68
4-9. Line Amplifier AM-3198/URC Trouble Shooting Chart 4-73

SECTION 6 - PARTS LIST

6-1. List of Units 6-2
SUPPLEMENTARY PARTS LIST 6-3
6-2. ~~Maintenance Parts List~~ . . . . 6-1A ~~6-3~~
6-3. List of Manufacturers 6-123

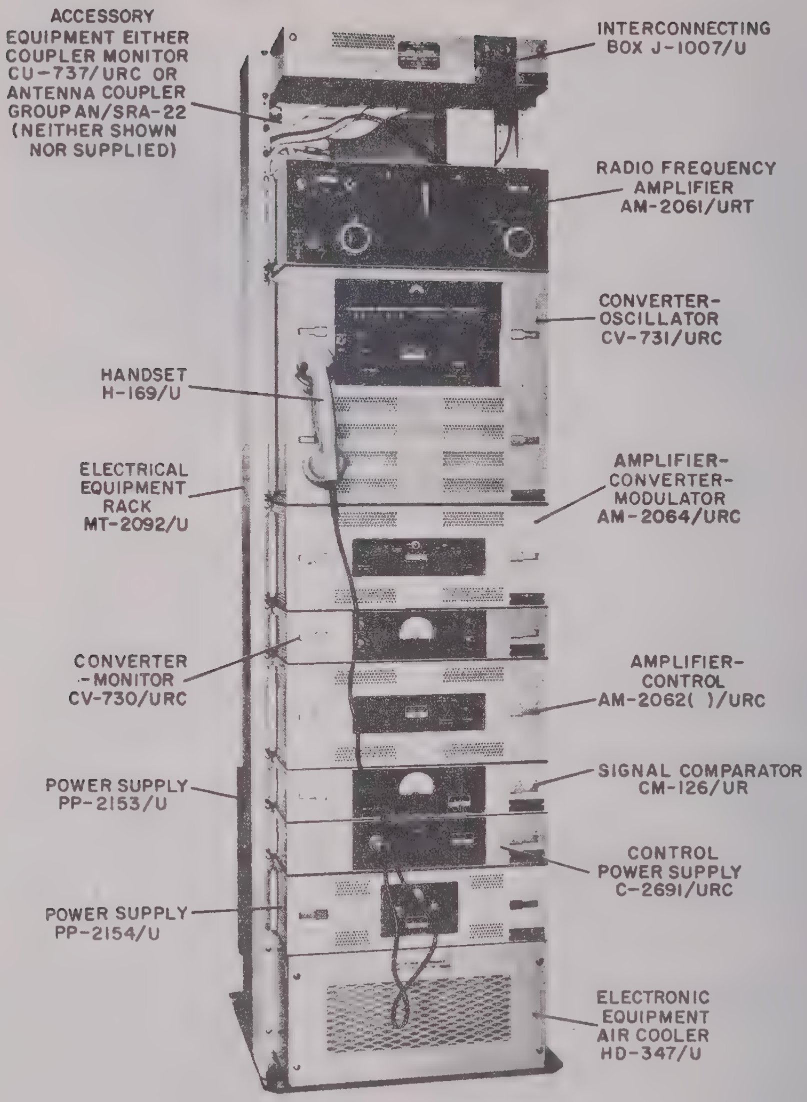

ACCESSORY EQUIPMENT EITHER COUPLER MONITOR CU-737/URC OR ANTENNA COUPLER GROUP AN/SRA-22 (NEITHER SHOWN NOR SUPPLIED)
INTERCONNECTING BOX J-1007/U
RADIO FREQUENCY AMPLIFIER AM-2061/URT
CONVERTER-OSCILLATOR CV-731/URC
HANDSET H-169/U
ELECTRICAL EQUIPMENT RACK MT-2092/U
AMPLIFIER-CONVERTER-MODULATOR AM-2064/URC
CONVERTER-MONITOR CV-730/URC
AMPLIFIER-CONTROL AM-2062( )/URC
POWER SUPPLY PP-2153/U
SIGNAL COMPARATOR CM-126/UR
CONTROL POWER SUPPLY C-2691/URC
POWER SUPPLY PP-2154/U
ELECTRONIC EQUIPMENT AIR COOLER HD-347/U

Figure 1-1. Radio Set AN/URC-32( )
(AN/URC-32B Version)

SECTION I

GENERAL INFORMATION

1-1. SCOPE.

This technical manual is in effect upon receipt and supersedes NavShips 93285(A). Extracts from this publication may be made to facilitate the preparation of other Department of Defense publications.

1-2. GENERAL DESCRIPTION.

Radio Set AN/URC-32( ) is a family of manually operated transceivers for use in the 2- to 30-megacycle range, with a peak-envelope-power (PEP) output of 500 watts during transmit. The equipments are designed primarily for single-sideband transmission with reception on upper, lower, or independent sidebands; each contains a separate audio and i-f channel for each of the sidebands during indepedent-sideband operation. All of the transceivers include circuitry for AM (carrier reinsertion on transmit), CW, and 850-cps shift FSK operation. The 2- to 30-megacycle range is covered in four bands: 2.0 to 3.7 mc, 3.7 to 7.7 mc, 7.7 to 15.7 mc, and 15.7 to 30.0 mc. The operating frequency is set in 1-kc increments via a direct-reading frequency counter in the AN/URC-32 and AN/URC-32A and 0.1-kc increment in the AN/URC-32B. Frequency accuracy and stability are controlled by a built-in frequency standard.

Refer to figure 1-1. The AN/URC-32( ) equipments are composed of ten functional units plus a dynamic handset mounted in a standard 19-inch open rack. All units except the dummy antenna, the blower, the low-voltage power supply, and the junction box are hinged at the left side for ease of maintenance. All operating controls are accessible from the front of the rack. Except for the high-voltage power supply and the junction box, all electrical connections are made through plugs and jacks to facilitate removal and replacement. The AN/URC-32( ) normally is used with antenna accessories Antenna Coupler Group AN/SRA-22 (see NAVSHIPS 93826) or Coupler Monitor CU-737/URC (see NAVSHIPS 93628) for complete system installation.

1-3. DESCRIPTION OF UNITS.

There are ten functional units plus the blower in the AN/URC-32 equipments; each of these units is briefly described below. Table 1-1 provides a cross reference between commercial, Army/Navy, and colloquial nomenclature for each of the units.

a. INTERCONNECTING BOX J-1007/U. - (Refer to figure 1-1.) The J-1007/U contains the main power fuse holders and space for mounting the terminal blocks of the interconnecting cables. Except for coaxial cable connections, all interconnections are made through Interconnecting Box J-1007/U. All interconnecting cables except those for the high-voltage power supply are terminated in connectors which mate with the major units.

b. RADIO FREQUENCY AMPLIFIER AM-2061/URT. - (Refer to figure 1-2.) The AM-2061/URT is a two-stage r-f power amplifier supplying an output of 500 watts peak envelope power (PEP) from a 0.15-watt-input signal. The AM-2061/URT contains a driver stage, a power amplifier stage, and a transmitter gain control (tgc) circuit. The plate circuits of the tubes are manually tuned over the 2.0- to 30-mc range.

c. CONVERTER-OSCILLATOR CV-731/URC. - (Refer to figure 1-3.) The CV-731/URC is used to translate i-f to r-f during transmit operation and r-f to i-f during receive operation. The unit contains an

TABLE 1-1. NOMENCLATURE CROSS-REFERENCE LIST

COLLINS RADIO COMPANY COMMERCIAL NOMENCLATURE	ARMY/NAVY NOMENCLATURE	COLLOQUIAL NAME
KWT-6 (8) Power Amplifier-367A-3	Radio Set AN/URC-32( ) Radio Frequency Amplifier AM-2061/URT	Transceiver power amplifier
Frequency Generator 786E-1	Converter-Oscillator CV-731/URC	Frequency generator
Sideband Generator 786F-1	Amplifier-Converter-Modulator AM-2064/URC	Sideband generator
Audio and Control Unit 159B-1	Amplifier-Control AM-2062/URC	Audio and control unit

TABLE 1-1. (Continued)

COLLINS RADIO COMPANY COMMERCIAL NOMENCLATURE	ARMY/NAVY NOMENCLATURE	COLLOQUIAL NAME
Audio and Control Unit 159B-2	Amplifier-Control AM-2062A/URC	Audio and control unit
High-Voltage Power Supply 428B-1	Power Supply PP-2153/U	High-voltage power supply
Low-Voltage Power Supply 429B-1	Power Supply PP-2154/U	Low-voltage power supply
Dynamic Handset	Dynamic Handset H-169/U and Cord Assembly CX-1846A/U	Dynamic handset
Handset Adapter	Control-Power Supply C-2691/URC	Handset adapter
Frequency Comparator 54Q-1	Signal Comparator CM-126/UR	Frequency comparator
CW and FSK Unit	Converter-Monitor CV-730/URC	CW and FSK unit
Dummy Antenna 172J-1	Electrical Dummy Load DA-218/U	Dummy antenna
Junction Box 153H-3	Interconnecting Box J-1007/U	Junction box
Blower 199G-3	Electronic Equipment Air Cooler HD-347/U	Blower
Mounting Rack and Shockmount	Electrical Equipment Rack MT-2092/U	Mounting rack and shockmount

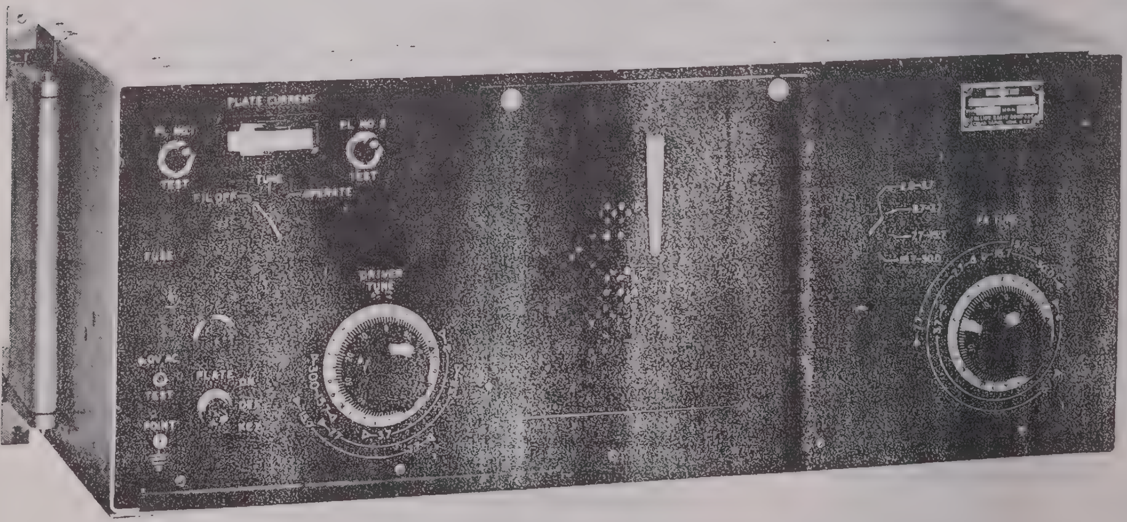


Figure 1-2. Radio Frequency Amplifier AM-2061/URT

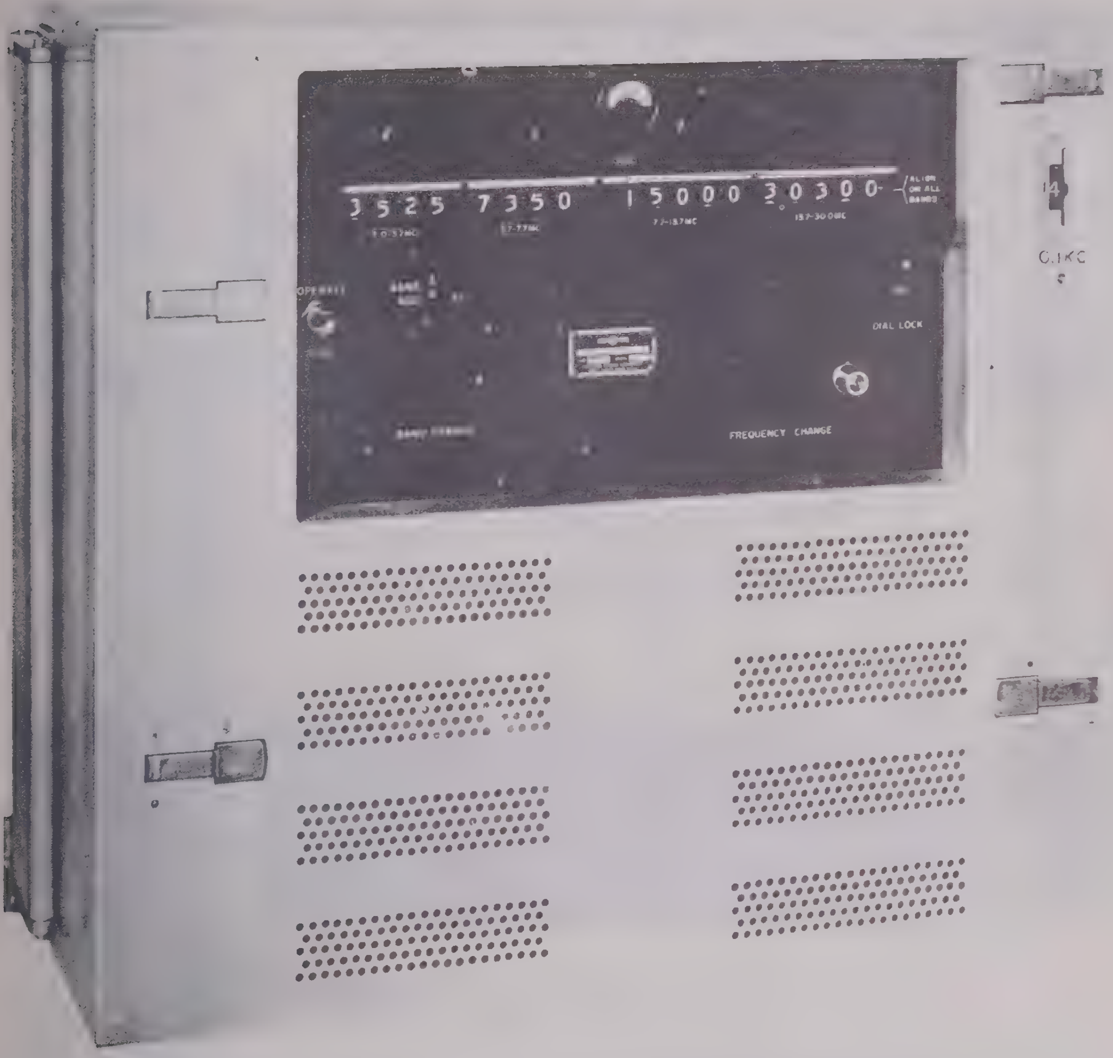


Figure 1-3. Converter-Oscillator CV-731/URC (AN/URC-32B Version)

r-f tuner, master oscillator, reference oscillator, sidestep oscillator, and frequency divider. Outputs of 100 kc and 1 kc are supplied to operate the sideband generator (AM-2064/URC) and the frequency comparator (CM-126/UR) respectively. The front panel of the CV-731/URC contains a direct-reading frequency counter and the controls used to select the operating frequency.

d. AMPLIFIER-CONVERTER-MODULATOR AM-2064/URC. - (Refer to figure 1-4.) The AM-2064/URC is used to translate audio frequencies to i-f during transmit operation and i-f to audio frequencies during receive operation. The unit contains upper-sideband, lower-sideband, and carrier-reinsertion (AM) i-f/a-f amplifiers; a transmitter gain control (tgc) circuit; and a carrier generator. Audio signals, routed from the audio and control unit (AM-2062( )/URC) during transmit operation, pass through upper- and lower-sideband filters in the AM-2064/URC, and a 300-kc output is supplied by the AM-2064/URC to the frequency generator (CV-731/URC). During receive operation a 300-kc i-f signal received from the frequency generator is amplified, filtered, and detected and the resulting audio signals are routed to the audio and control unit. During all operational modes except FSK, a 100-kc signal from the CW and FSK unit (CV-730/URC) is multiplied by the AM-2064/URC and supplied as a carrier injection signal for tuning and AM operation. During FSK receive operation, a beat-frequency oscillator signal (bfo) supplied by the CW and FSK unit is applied to the USB i-f/a-f amplifier in the AM-2064/URC.

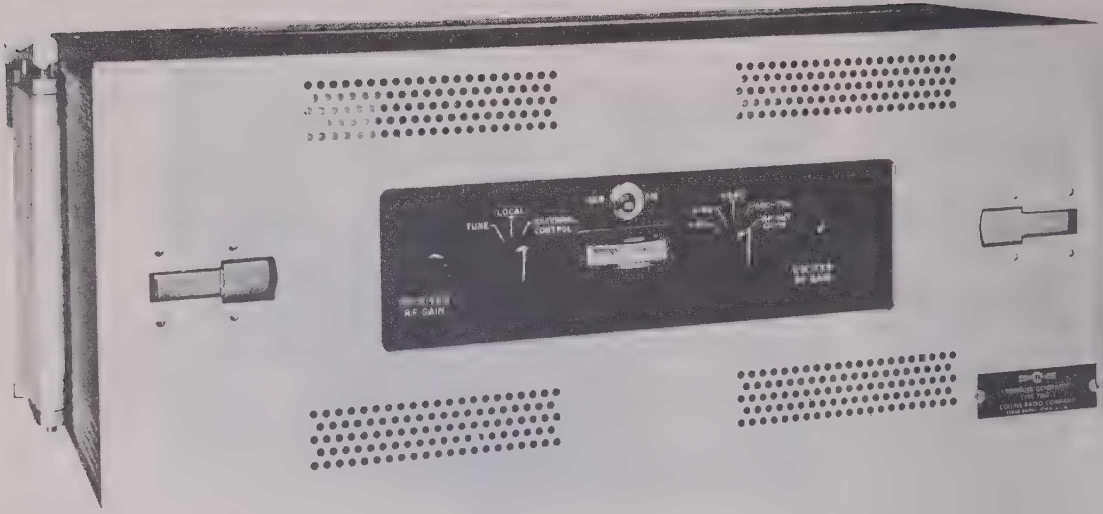


Figure 1-4. Amplifier-Converter-Modulator AM-2064/URC

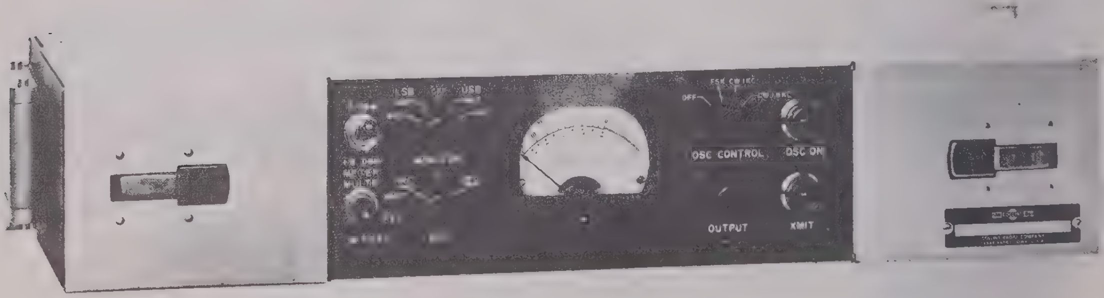


Figure 1-5. Converter-Monitor CV-730/URC

The front panel of the AM-2064/URC contains the r-f gain controls for the receiver and exciter and selection switches for AM or single-sideband operation and local or remote tuning.

e. CONVERTER-MONITOR CV-730/URC. - (Refer to figure 1-5.) The CV-730/URC is used to permit the AN/URC-32( ) to be operated CW (continuous wave) by a CW key or FSK (frequency-shift keying) by a teletypewriter loop (60 ma). During transmit operation, the unit supplies audio tone outputs to the USB circuits in the sideband generator (AM-2064/URC). For CW operation, the CV-730/URC provides a choice of two different audio-keyed tones, a 1-kc tone, or a 1.5-kc tone. For FSK operation, audio tones of 1575 cps for space (0 ma), 2425 cps for mark (60 ma), and 850 cps for shift are provided. During FSK receive operation, the CV-730/URC supplies a variable bfo signal to the sideband generator replacing the normal 100-kc reference signal. The bfo signal is centered at 300.550 kc and varied 1 kc above and below this value. The replacement is necessary to provide the space and mark audio tone output compatible with the URA-8( ) converters. The front panel of the CV-730/URC contains metering circuits for monitoring the audio outputs of the audio and control unit (AM-2062( )/URC) as well as the CV-730/URC.

f. AMPLIFIER-CONTROL AM-2062( )/URC. - (Refer to figure 1-6.) The AM-2062( )/URC is a dual-channel amplifier with audio inputs for two 600-ohm balanced lines and a 600-ohm unbalanced line. During transmit operation, the audio signals from the handset adapter (C-2691/URC) are applied to the unbalanced line of the audio and control unit (AM-2062( )/URC). The LSB and USB outputs are routed to the balanced modulator in the sideband generator (AM-2064/URC). During receive operation the USB or LSB output of the sideband generator is applied to the audio and control unit (AM-2062( )/URC); the output of the unit is routed to the handset adapter.

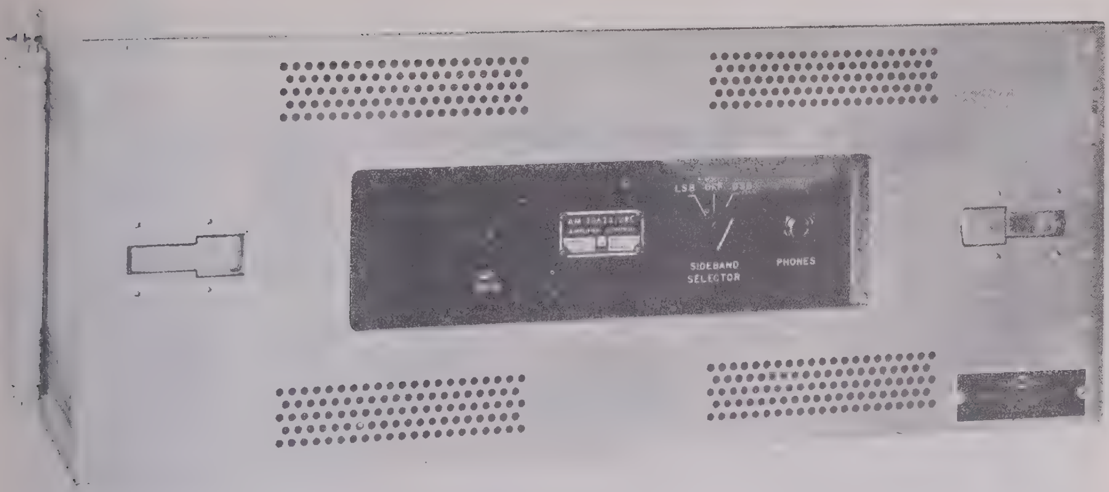


Figure 1-6. Amplifier-Control AM-2062A/URC
(AN/URC-32A and AN/URC-32B Version)

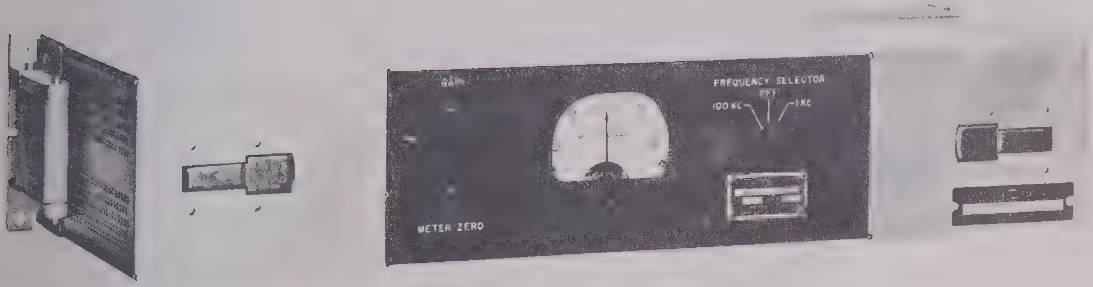


Figure 1-7. Signal Comparator CM-126/UR

The front panel of the audio and control unit (AM-2062( )/URC) contains a microphone gain control and a sideband selector. The earlier version (AM-2062/URC) provided a microphone input receptacle on the front panel and a microphone amplifier module. This has been eliminated in the AM-2062A/URC version.

g. SIGNAL COMPARATOR CM-126/UR. - (Refer to figure 1-7.) The CM-126/UR is used to compare a reference oscillator signal with a signal from an external frequency standard. Two different methods of comparison may be used. In one method, a 100-kc reference oscillator signal is compared with a 100-kc external standard, such as the Navy AN/URQ-9; this may be done without interrupting normal operation. The other method compares a 1-kc output from the frequency standard with a received signal (heterodyned to 1 kc) from a netting station or a transmitted frequency standard such as WWV; this method results in interruption of normal operation. A meter on the front panel of the frequency comparator (CM-126/UR) oscillates at a frequency equal to the difference of the frequencies being compared. When the 1-kc standard is compared with a transmitter frequency standard, the output of the frequency comparator (CM-126/UR) can be connected to the dynamic handset or a speaker. This permits frequency differences too great to be indicated on the meter to be heard as a beat note.

h. CONTROL-POWER SUPPLY C-2691/URC AND DYNAMIC HANDSET H-169/U. - (Refer to figures 1-1, 1-8, and 1-9.) The C-2691/URC is used to enable local operation of the AN/URC-32( ) with a dynamic handset or remote operation using Radio Set Control C-1138/UR or equivalent and a handset. A front panel control connects audio input, audio output, and transmit key line to either the local or remote operating position. The unit contains a 12-volt d-c supply and microphone transformer necessary

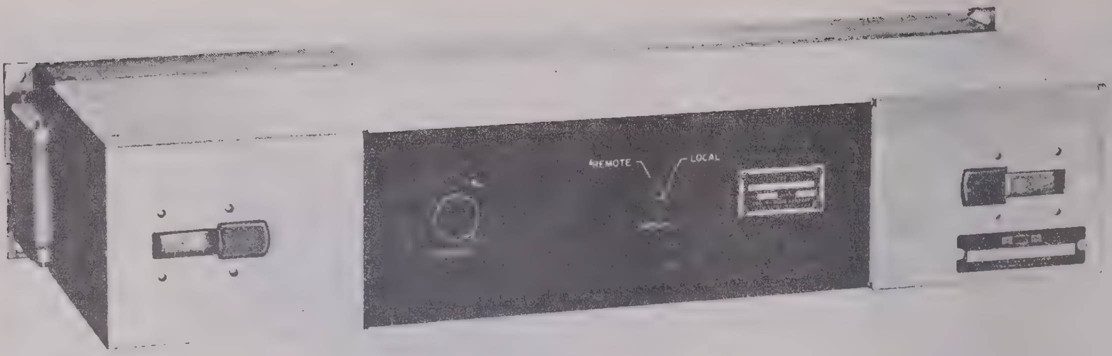


Figure 1-8. Control-Power Supply C-2691/URC

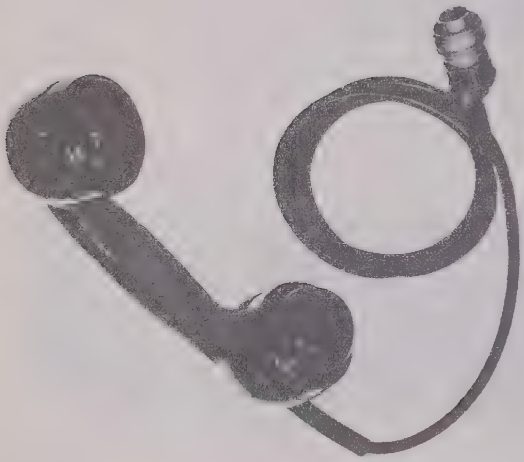


Figure 1-9. Dynamic Handset H-169/U and Cord Assembly CX-1846A/U

for operation of the dynamic handset (H-169/U) and the C-1138/UR.

The dynamic handset (H-169/U) contains a noise-canceling dynamic microphone, transistor amplifier, dynamic receiver, and push-to-talk switch.

i. POWER SUPPLY PP-2154/U. - (Refer to figure 1-10.) The PP-2054/U is the low-voltage power supply. The unit can be operated on a 115- or 230-volt, 60-cps, single-phase source; 185 watts of input power is required. The unit contains no tubes, and all voltage rectifiers operate from a common power transformer. The output voltages are +250 volts, 37 ma, filtered; +130 volts, 315 ma, filtered; +28 volts, 1.5 amp, unfiltered; +28 volts, 580 ma, semifiltered; +28 volts, 180 ma, regulated; -90 volts, 6 ma, filtered; 12.6 volts ac (ct), 5.2 amp; and 35 volts ac, 500 ma.

j. ELECTRONIC EQUIPMENT AIR COOLER HD-347/U. - (Refer to figure 1-11.) The HD-347/U is of the centrifugal-type capable of delivering 125 cfm of air at 1.83 inches of water equivalent pressure. The prime mover in the unit is a 115/230-volt, single-phase induction motor. Air is supplied through an air filter located at the front. The unit contains

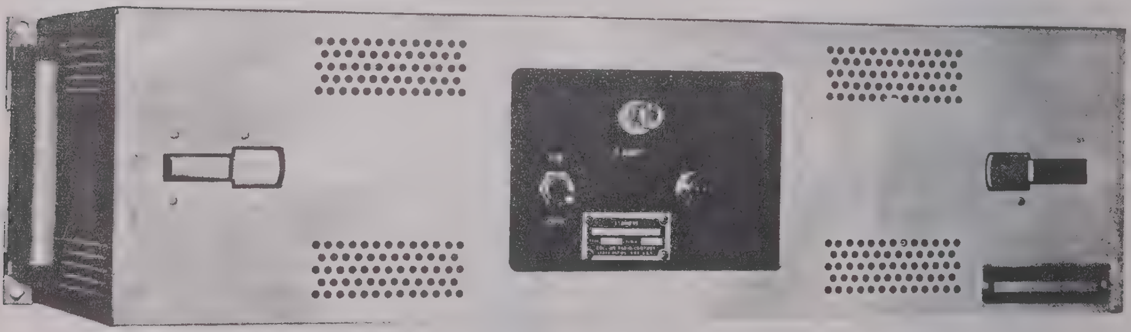


Figure 1-10. Power Supply PP-2154/U

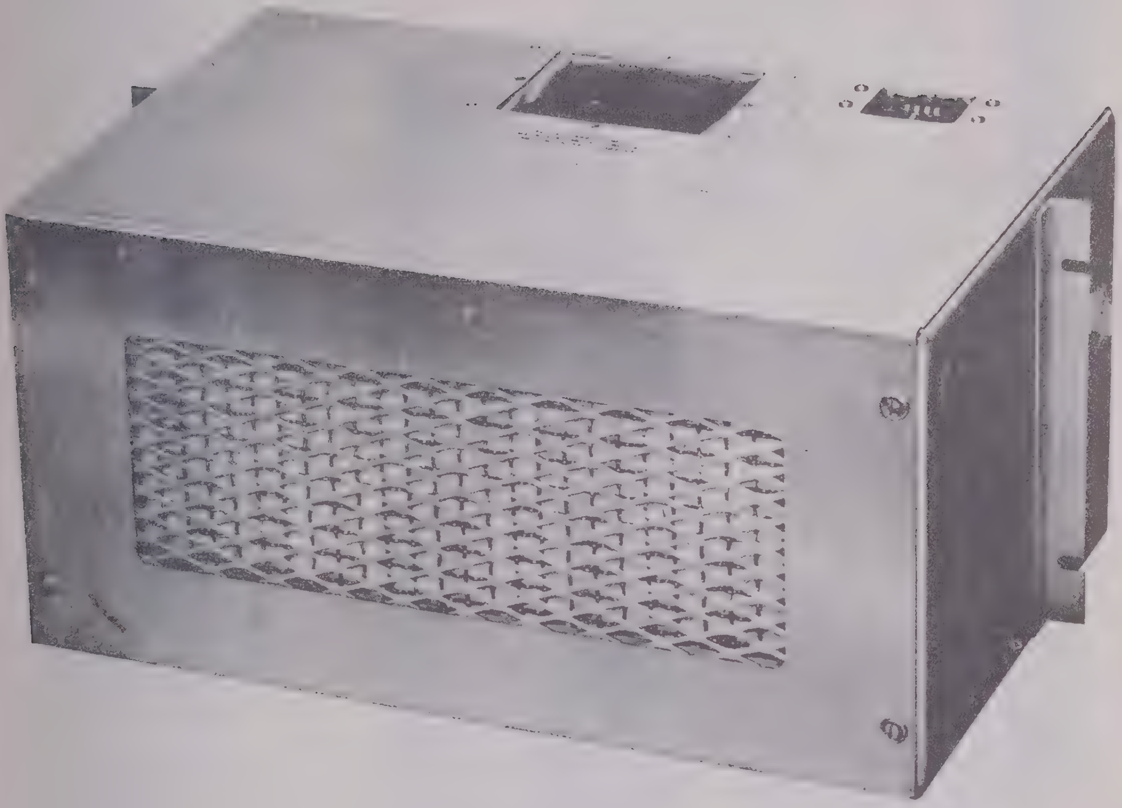


Figure 1-11. Electronic Equipment Air Cooler HD-347/U

an air-operated interlock switch the contacts of which are in series with primary power to the AN/URC-32( ) equipment.

k. POWER SUPPLY PP-2153/U. - (Refer to figures 1-12 and 1-14.) The PP-2153/U is a high-voltage power supply composed of a transformer, two rectifier bridge circuits, and filter and bleeder circuits. The supply can be operated on a 115- or 230-volt, 60-cps, single-phase source; 1245 watts of input power are required. The output voltages which are used in the power amplifier (AM-2061/URT) are +2000 volts at 500 ma and +400 volts at 80 ma.

l. ELECTRICAL DUMMY LOAD DA-218/U. - (Refer to figures 1-13 and 1-14.) The DA-218/U is a 50-ohm unbalanced, 500-watt nonradiating load. The unit is mounted on the air duct at the rear of the AN/URC-32( ) and receives cooling air through an opening in the mounting surface. The DA-218/U is connected to the dummy load output of the antenna tuning control. A switch allows the operator to connect the dummy load for tuning and testing in the transmit mode.

1-4. REFERENCE DATA.

The reference data for Radio Set AN/URC-32( ) is given in table 1-2.

1-5. EQUIPMENT SUPPLIED.

Table 1-3 lists all equipment and publications supplied with Radio Set AN/URC-32( ).

1-6. ACCESSORY EQUIPMENT.

Table 1-4 lists all accessory equipment (but not supplied) for the AN/URC-32( ).

1-7. TEST AND MAINTENANCE EQUIPMENT REQUIRED BUT NOT SUPPLIED.

A list of all equipment required but not supplied is given in table 1-5.

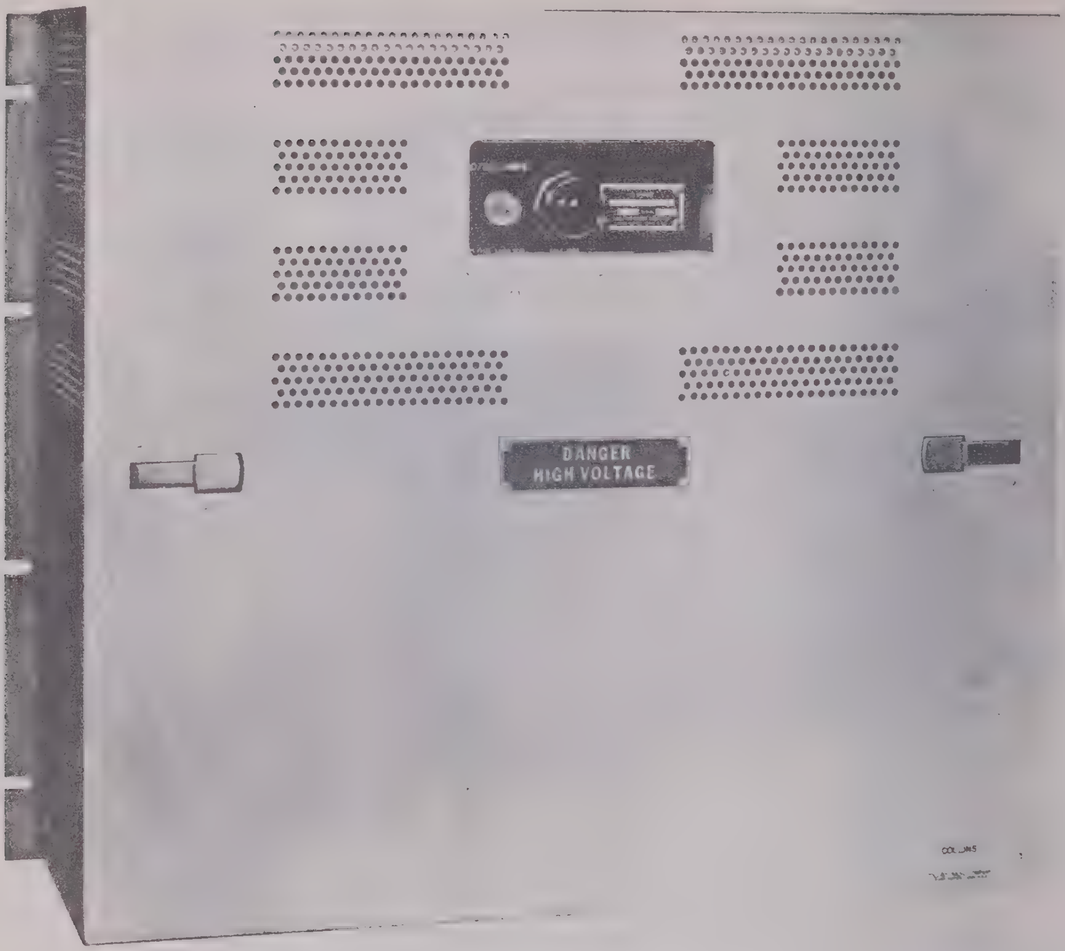

DANGER
HIGH VOLTAGE

Figure 1-12. Power Supply PP-2153/U

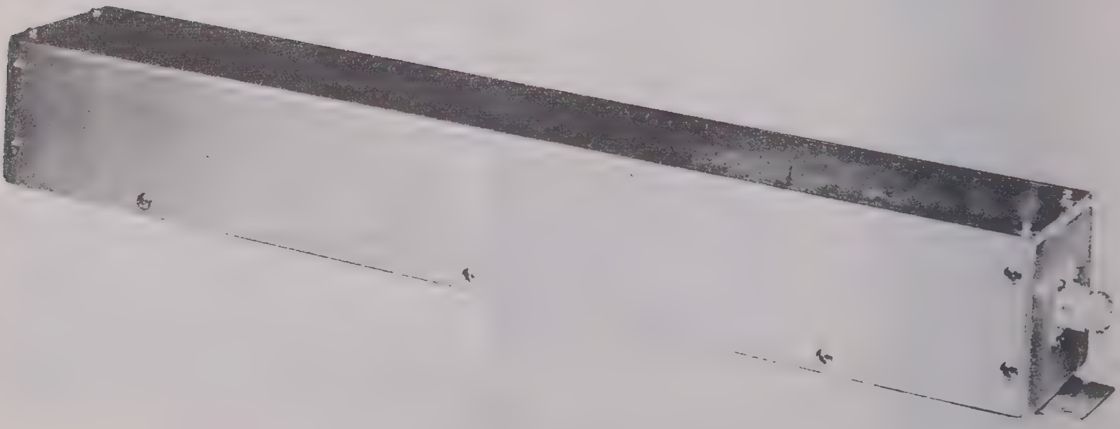


Figure 1-13. Electrical Dummy Load DA-218/U

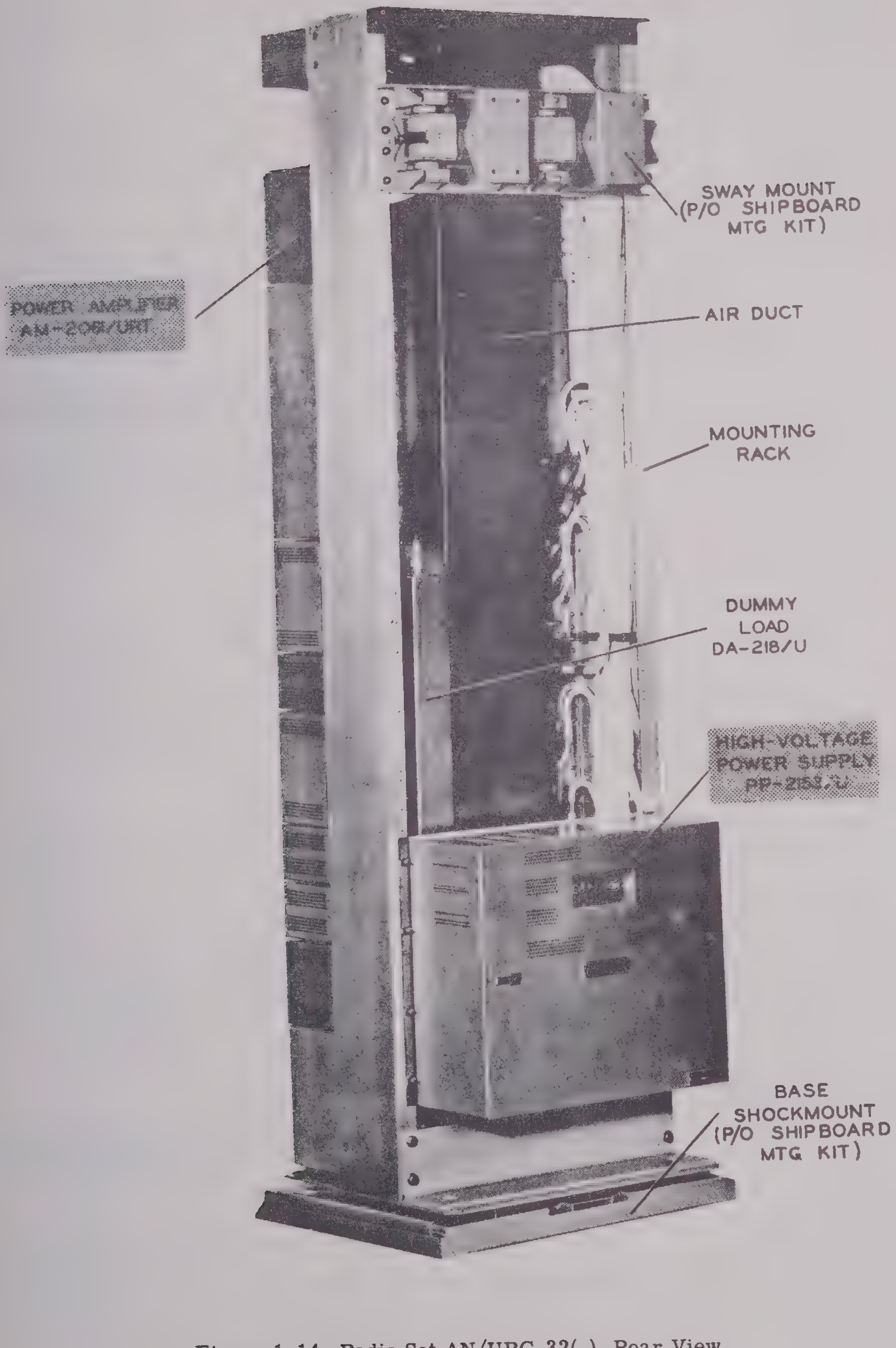

SWAY MOUNT
(P/O SHIPBOARD
MTG KIT)
POWER AMPLIFIER
AM-2062/URT
AIR DUCT
MOUNTING
RACK
DUMMY
LOAD
DA-218/U
HIGH-VOLTAGE
POWER SUPPLY
PP-2153/U
BASE
SHOCKMOUNT
(P/O SHIPBOARD
MTG KIT)

Figure 1-14. Radio Set AN/URC-32( ), Rear View

TABLE 1-2. REFERENCE DATA FOR RADIO SET AN/URC-32( )

CHARACTERISTIC	NUMBER, RANGE, AND/OR VALUE
Frequency range	2.0 to 30.0 mc.
Wavelength	150 to 10 meters.
Tuning	
Number of bands	4. Band 1 . . . . 2.0 to 3.7 mc Band 2 . . . . 3.7 to 7.7 mc Band 3 . . . . 7.7 to 15.7 mc Band 4 . . . . 15.7 to 30.0 mc
Number of channels	28,000 spaced at 1-kc intervals (AN/URC-32 and AN/URC-32A); 280,000 spaced at 0.1-kc intervals (AN/URC-32B).
Frequency stability	1 part in 10^6 per month and 1 part in 10^8 per day under all ambient conditions (using internal frequency standard).
Operating modes	CW telegraph (A1). Double-sideband, full carrier (A3). Single-sideband (USB and LSB), reduced carrier (A3a). Independent-sideband, reduced carrier (A3b). Single-sideband (USB and LSB), suppressed carrier (A3j). Composite transmission (A9). Single-sideband (USB), full carrier (A3H compatible) on transmit. Frequency-shift telegraphy (F1) (850-cps shift).
Carrier suppression	45 db below peak-envelope-power output.
Suppression of undesired sideband	35 db below peak-envelope-power output.
Number of superheterodyne conversions (transmit and receive)	One in band 1; two in bands 2, 3, and 4.
Intermediate frequencies	300 kc (fixed), and 1.7 to 3.7 mc (continuously variable).
Receiver Characteristics (Cont)	
Sensitivity	1 microvolt for 10-db signal plus noise-to-noise ratio.
Selectivity	3-kc bandwidth on either sideband; 6-kc bandwidth on AM.
Input impedance	50 ohms unbalanced.
Audio distortion	5 percent maximum.

TABLE 1-2. (Continued)

CHARACTERISTIC	NUMBER, RANGE, AND/OR VALUE
Receiver Characteristics (Cont)	
Audio outputs	
USB and LSB lines	+14 to -34 dbm (adjustable) into 600 ohms balanced.
Phones	600-ohm headphones.
Speaker	3 watts maximum into 3- to 4- or 600-ohm speaker.
Audio-frequency response	±2 db from 300 to 3000 cps referenced to 1000 cps.
FSK	Receiver output (audio) is centered on 2550 cps for compatibility with Navy teletypewriter converters.
Transmitter Characteristics	
Power output	
A1	500 watts.
A3H (compatible)	125 watts carrier power.
A3a	500 watts PEP.
A3b	500 watts PEP total.
A3J	500 watts PEP total.
A9	500 watts PEP total.
F1	500 watts.
Distortion	35 db below PEP output (3rd order distortion).
Output impedance	50 ohms unbalanced.
Audio inputs	
USB and LSB lines	-38 to +8 dbm into 600 ohms balanced.
Remote audio input	600 ohms balanced.
FSK	850-cps shift centered on 2000 cps in upper sideband.
Control crystals in Converter-Oscillator CV-731/URC	
Sidestep oscillator (Cont)	
Designation	Type CR-18/U modified.
Type of cut	AT.
Frequency range of crystal circuit	1.942 to 1.945 mc.

TABLE 1-2. (Continued)

CHARACTERISTIC	NUMBER, RANGE, AND/OR VALUE
Sidestep oscillator (Cont)	
Crystal oscillation frequencies:	
Y1	1.942 mc.
Y2	1.944 mc.
Y3	1.943 mc.
Y4	1.945 mc.
Temperature coefficient	1.5 parts in 10^7 per degree centigrade from +70°C (+158°F) to +81°C (+178°F).
Operating temperature	+80°C (+176°F).
Temperature range	-55°C (-67°F) to +105°C (+221°F).
Accuracy	±0.005 percent of oscillation frequency.
Stability	±0.0005 percent.
100-kc reference oscillator	
Designation	Type CR-18/U modified.
Type of cut	AT.
Frequencies of crystal circuit	100 kc, 600 kc, 2.4 mc, and 3.0 mc.
Crystal oscillation frequency (Y1)	3.000000 mc.
Temperature coefficient	1.5 parts in 10^7 per degree centigrade from +70°C (+158°F) to +81°C (+178°F).
Operating temperature	+80°C (+176°F).
Temperature range	-55°C (-67°F) to +105°C (+221°F).
Accuracy	±0.005 percent of oscillation frequency.
Stability	±0.0005 percent.
0.1-kc tuning module (Cont)	
Designation	Type CR-47A/U.
Type of cut	AT.
Frequency range of crystal circuit	1000 cps.

TABLE 1-2. (Continued)

CHARACTERISTICS	NUMBER, RANGE, AND/OR VALUE
0.1-kc tuning module (Cont)	
Crystal oscillation frequencies	
Y1	212.100 kc.
Y2	212.200 kc.
Y3	212.300 kc.
Y4	212.400 kc.
Y5	212.500 kc.
Y6	212.600 kc.
Y7	212.700 kc.
Y8	212.800 kc.
Y9	212.900 kc.
Y10	213.000 kc.
Temperature coefficient	1.5 parts in 10^7 per degree centigrade from +70°C (+158°F) to +80°C (+176°F).
Operating temperature	+~~80~~75°C (+~~176~~167°F).
Operable temperature range	+70°C (+158°F) to +80°C (+176°F).
Accuracy	±0.002 percent of oscillation frequency.
Stability	±0.0005 percent.
Primary voltage requirements	115 volts ±10 percent, 2-wire, 230 volts ±10 percent 2-wire, or 3-wire a-c, 50/60 cps ±5 percent, single phase.
Power requirements	
Receive	1000 watts.
Transmit	1500 watts.
Ambient operating temperature	0°C (+32°F) to +50°C (+122°F).
Altitude	Up to 10,000 feet.
Relative humidity	0 to 95 percent.

TABLE 1-3. EQUIPMENT SUPPLIED FOR RADIO SET AN/URC-32( )

QTY PER EQUIP	NOMENCLATURE		UNIT NO.	OVER-ALL DIMENSIONS (inches)			VOLUME (cu ft)	WEIGHT (lb)
	NAME	DESIGNATION		HEIGHT	WIDTH	DEPTH		
1	Radio Frequency Amplifier	AM-2061/URT	2	6.85	18.85	8.5	0.62	21
1	Converter-Oscillator	CV-731/URC	3	15.63	18.85	7.0	1.20	41.5
1	Amplifier-Converter-Modulator	AM-2064/URC	4	7.0	19.0	7.0	0.54	14.5
1	Converter-Monitor	CV-730/URC	5	3.5	19.0	7.0	0.28	7.5
1	Amplifier-Control	AM-2062/URC AM-2062A/URC	6 7	7.0	19.0	7.0	0.54	15.3
1	Signal Comparator	CM-126/UR	8	3.5	19.0	7.0	0.28	5.8
1	Control-Power Supply	C-2691/URC	9	3.5	19.0	7.0	0.3	12.0
1	Power Supply	PP-2153/U	13	15.8	19.0	7.0	1.2	93.0
1	Power Supply	PP-2154/U	11	5.13	18.9	7.0	0.4	23.0
1	Electronic Equipment Air Cooler (Blower)	HD-347/U	12	8.9	19.0	11.3	1.1	22.0
1	Interconnecting Box	J-1007/U	1	3.5	19.0	7.0	0.3	4.0
1	Dynamic Handset	H-169/U	10					2.3
1	Electrical Dummy Load	DA-218/U	17	20.8	2.8	2.6		4.0
1	Electrical Equipment Mounting Rack	MT-2092/U	14	70.5	21.9	6.0		75
1	Radio Set	AN/URC-32( )		73.0	21.9	20.9		*450
1	Technical Manual	NAVSHIPS 93285(B)		11.5	9.5	2.0		
1	Maintenance Standards Book	NAVSHIPS 93285.42(A)		11.5	9.5	1.0		
1	Performance Standard Sheet	NAVSHIPS 93285.42(A)						
1	Operator's Instruction Chart	NAVSHIPS 93285.21(A)						

*Weight includes shockmount base and stabilizer.

TABLE 1-4. ACCESSORY EQUIPMENT

QTY PER EQUIP	NOMENCLATURE		OVER-ALL DIMENSIONS (inches)			VOLUME (cu ft)	WEIGHT (lb)
	NAME	DESIGNATION	HEIGHT	WIDTH	DEPTH		
1	Isolation Amplifier Module	AM-1785/GRC	4.0	2.8	4.0		
1	Electronic Equipment Installation Kit	MK-446A/URC-32					
1	Electrical Equipment Maintenance Kit	MK-447/URC-32					
1	Replacement Module Kit	MK-464/URC					
1	Coupler Monitor	CU-737/URC	5.13	19.0	7.0	0.4	10.0
1	Antenna Coupler Group	AN/SRA-22	5.13	19.0	7.0	0.4	17.0

TABLE 1-5. EQUIPMENT REQUIRED BUT NOT SUPPLIED

QTY PER EQUIP	NOMENCLATURE		REQUIRED USE	REQUIRED CHARACTERISTICS
	NAME	DESIGNATION		
2	Audio Oscillator	TS-382/U	Trouble-shooting and maintenance procedures.	20 to 20 kc, 4 bands.
1	Communications Receiver	R-390/URR	Trouble-shooting and maintenance procedures.	2 to 30 mc.
1	Electronic Voltmeter	ME-26A/U	Trouble-shooting and maintenance procedures.	0 to 300 volts ac; 0 to 1000 volts dc; ±3 percent accuracy; frequency response: 20 cps to 700 mc.
1	Electronic Voltmeter	AN/USM-143	Trouble-shooting and maintenance procedures.	0.001 to 300 volts ac; ±2 percent accuracy; frequency response: 100 kc to 2 mc, -72 dbm to +52 dbm.
1	Electronic Voltmeter	AN/USM-106	Trouble-shooting and maintenance procedures.	0.01 to 1000 volts ac; ±3 percent accuracy; frequency response: 15 cps to 3 mc.
1	Frequency Meter	AN/USM-26	Trouble-shooting and maintenance procedures.	10 cps to 100 mc.

TABLE 1-5. (Continued)

QTY PER EQUIP	NOMENCLATURE		REQUIRED USE	REQUIRED CHARACTERISTICS
	NAME	DESIGNATION		
2	Multimeter	AN/PSM-4C	Trouble-shooting and maintenance procedures.	0 to 1000 volts ac; 0 to 4000 volts dc; 0 to 300 megohms; ±3 percent accuracy.
1	Electronic Multimeter	AN/USM-116	Trouble-shooting and maintenance procedures	0 to 1000 volts dc, 0 to 300 volts ac, 0 to 1 amp dc, 0 to 10 megohms.
1	Oscilloscope	OS-46/U	Trouble-shooting and maintenance procedures.	Sweep 2 cps to 30 kc; 0.1 volt/cm vert., 0.12 volt/cm horiz. frequency response: dc to 300 kc down 3 db.
1	R-F Signal Generator	AN/URM-25F	Trouble-shooting and maintenance procedures.	10 kc to 50 mc, 8 bands; AM, CW; 0.1 uv to 0.1 volt into 50 ohms; 2 volts open circuit; audio output: 0 to 3 volts at 400 cps or 1 Kcps.
1	Transistor Checker	TS-1100A/U	Trouble-shooting and maintenance procedures.	
1	Tube Checker	TV-7D/U	Trouble-shooting and maintenance procedures.	
2	Resistors		Trouble-shooting and maintenance procedures.	10 kilohms, 1/2 watt.
1	Resistor		Trouble-shooting and maintenance procedures.	600 ohms, 1/2 watt.
1	Resistor		Trouble-shooting and maintenance procedures.	1000 ohms, 1/2 watt.
1	Resistor		Trouble-shooting and maintenance procedures.	33 ohms, 1/2 watt.
1	Resistor		Trouble-shooting and maintenance procedures.	47 ohms, 10 watt, wirewound.

TABLE 1-5. (Continued)

QTY PER EQUIP	NOMENCLATURE		REQUIRED USE	REQUIRED CHARACTERISTICS
	NAME	DESIGNATION		
1	Resistor		Trouble-shooting and maintenance procedures.	51 ohms, 1/2 watt.
1	Resistor		Trouble-shooting and maintenance procedures.	150 ohms, 1/2 watt.
1	Resistor		Trouble-shooting and maintenance procedures.	330 ohms, 1/2 watt.
1	Capacitor		Trouble-shooting and maintenance procedures.	5 pf, fixed, mica.
1	Capacitor		Trouble-shooting and maintenance procedures.	470 pf, fixed, mica or ceramic
1	Parallel tuning circuit		Trouble-shooting and maintenance procedures.	Able to tune to any frequency in 2- to 30-mc range.

1-8. FACTORY CHANGES.

Table 1-6 lists the factory changes made on units used in the AN/URC-32( ). A system of manufacturing change numbers (MCN) was put into effect whereby all main chassis and modules have an MCN stamped on them. When a modification occurred, the MCN of the first unit to receive the modification was recorded. This system was incorporated on all Collins Radio Company chassis and modules shipped beginning with contract NObsr-81220. Radio Set AN/URC-32 serial number 360 was the first equipment built under this contract.

The table is divided into four columns; one for the unit, one for the serial number ot the modification, one for the MCN number of the modified unit, and one for a description of the modification. A dotted line across the table indicates when the modifications were made.

Reference made to CPN signifies Collins part number.

TABLE 1-6. FACTORY CHANGES ON THE AN/URC-32( )

UNIT	SERIAL NO. OF FIRST RADIO TO RECEIVE MODIFICATION	MCN OF FIRST UNIT TO RECEIVE MODIFICATION	MODIFICATION
Interconnecting Box J-1007/U (Cont)	360	1	Replaced with CPN 522-2363-00 which has new fuse holders and a receiver input protection device.

TABLE 1-6. (Continued)

UNIT	SERIAL NO. OF FIRST RADIO TO RECEIVE MODIFICATION	MCN OF FIRST UNIT TO RECEIVE MODIFICATION	MODIFICATION
Interconnecting Box J-1007/U (Cont)	596		Wiring change to allow on-off switch in Power Supply PP-2154/U to control power to all units. Removed jumper from TBJ-4 to TBP-4. Connected jumper from TBJ-4 to TBP-9.
	658	299	Added 800-ohm, 11-watt resistor CPN 747-0249-00 across TTY input.
	627	268	Rerouted primary power to prevent power being applied if blower switch fails. Deleted wire J4 to P9; added wires J4 to S11 and S4 to ~~S12~~ P9.
18 December 1961 . . .	. . . .	. . . .	. . . .
	821		Added jumpers L13 to L14 and L15 to L16 to permit use of tgc-vox antivox module (when used).
	822		Deleted jumpers J7 to G7, H12 to J7, and H14 to J15. Added H14 to J7, J15 to J16, and H12 to G7. This made to improve keying sequence of AM-2061/URT. See PA MCN 1568.
1 November 1962 . . .	. . . .	. . . .	. . . .
			Added jumper J6 to G7 (PA TEST KEY line). Must coincide with AM-2061/URT PA MCN 1770 change to be effective.
Amplifier-Control AM-2062/URC (Cont)	360	801	J6 changed to CPN 358-1040-00; changed to allow use of speaker in accessory antenna multicoupler at the same time headphones are plugged into unit.
	615		Removed microphone amplifier (356C-1), microphone input receptacle, and transformer T6.

TABLE 1-6. (Continued)

UNIT	SERIAL NO. OF FIRST RADIO TO RECEIVE MODIFICATION	MCN OF FIRST UNIT TO RECEIVE MODIFICATION	MODIFICATION
Amplifier-Control AM-2062/URC (Cont)			
1 November 1962	. . . .	. . . .	. . . .
AN/URC-32A	Serial No. 1		AM-2062/URC deleted, AM-2062A/URC added (includes AM-3198 modules in lieu of 356C-1).
Amplifier-Converter-Modulator AM-2064/URC	235		Added R31, 10,000 ohms, 2 watts, CPN 745-5694-00. Changed S1 from one wafer to two wafers.
	360	801	Added CR6 and CR7, 1N457, CPN 353-0204-00. CR1, CR6, and CR7 are connected so that r-f gain control also controls the gain of the i-f amplifiers. Chassis with this modification are marked MOD AB.
		1113	Added C36, 0.47 uf, CPN 931-4516-00. C36 added to prevent arcing between relay contacts.
	360	801	Changed silk screen REMOTE to EXTERNAL CONTROL.
Carrier generator module (Cont)			Modification A: Choice of values for R2 increased as follows: 33,000 ohms, 1/2 watt, CPN 745-1414-00. 39,000 ohms, 1/2 watt, CPN 745-1418-00. 43,000 ohms, 1/2 watt, CPN 745-1420-00. Choice of values for C3 increased as follows: 270 uuf, 0.1 percent CPN 912-3471-00. 260 uuf, 0.1 percent, CPN 912-3492-00.

TABLE 1-6. (Continued)

UNIT	SERIAL NO. OF FIRST RADIO TO RECEIVE MODIFICATION	MCN OF FIRST UNIT TO RECEIVE MODIFICATION	MODIFICATION
Carrier generator module (Cont)			Modification B: Changed L1, 1 mh, CPN 240-0591-00 to CPN 240-0595-00. L1 changed to meet specifications.
USB i-f/a-f module		1778	Modification A: Deleted C19. Added C30, 0.02 uf, CPN 913-3022-00.
		2135	C18, 0.0047 uf changed to 0.0068 uf, CPN 931-4502-00.
		2579	Tested selection of C8; values range from 82 to 120 uuf. C15 changed to 0.001 uf, CPN 931-4560-00. C18 changed to 0.01 uf CPN 931-4481-00.
		2423	R24 changed to 56K, CPN 745-1426-00.
1 November 1962	. . . .	. . . .	. . . .
		3295	Relocated C30, 0.02 uf was T3-1 to T3-3, now T3-1 to T3-5.
		3296	Added resistor selection for R32: 150K, 1/2 watt; 180K, 1/2 watt.
LSB i-f/a-f module (Cont)		2150	C18 0.0047 uf changed to 0.0068 uf, CPN 931-4502-00.
		1785	Modification A: Deleted C19. Added C30, 0.02 uf, CPN 913-3022-00.
		2620	Tested selection of C8; values range from 82 to 120 uuf. C15 changed to 0.001 uf, CPN 931-4560-00; C18 changed to 0.01 uf, CPN 931-4481-00.
		2436	R24 changed to 56K, CPN 745-1426-00.

TABLE 1-6. (Continued)

UNIT	SERIAL NO. OF FIRST RADIO TO RECEIVE MODIFICATION	MCN OF FIRST UNIT TO RECEIVE MODIFICATION	MODIFICATION
LSB i-f/a-f module (Cont)			
1 November 1962 . . .	. . . .	. . . .	. . . .
		3316	Relocated C30, 0.02 uf was T3-1 to T3-3, now T3-1 to T3-5.
		3316	Added resistor selection for R32: 150K, 1/2 watt; 180K, 1/2 watt.
AM i-f/a-f module		2027	R6 changed to 82 ohms, 1/2 watt, CPN 745-1307-00. R1 changed to 1000 ohms, 1/2 watt, CPN 745-1352-00. Added R31, 1000 ohms, CPN 381-111-00.
		2372	C6 values selected 75 uuf to 114 uuf.
18 December 1961 . . .	. . . .	. . . .	. . . .
		2680	C28 added, 0.02 uf, CPN 913-3022-00. C29 added, 4.7 uf, CPN 184-7396-00.
1 November 1962 . . .	. . . .	. . . .	. . . .
		3100	Relocated C28; was T4-1 to T4-3, now T4-1 to T4-5. Added choice for R32: 150K, 1/2 watt; 180K, 1/2 watt.
Balanced modulator module (Cont)		2264	Capacitors C3, C4, and C5 are now selected in final test. Usable test selected values are as follows: C3 and C4 — CPN 180 uuf — 912-1850-00 200 uuf — 912-1853-00 220 uuf — 912-1856-00 240 uuf — 912-1859-00 270 uuf — 912-1862-00 C5 — CPN 91 uuf — 912-1829-00 100 uuf — 912-1832-00 110 uuf — 912-1835-00 120 uuf — 912-1838-00 130 uuf — 912-1841-00

TABLE 1-6. (Continued)

UNIT	SERIAL NO. OF FIRST RADIO TO RECEIVE MODIFICATION	MCN OF FIRST UNIT TO RECEIVE MODIFICATION	MODIFICATION
Balanced modulator module (Cont)		3137	R11 and R12 changed to 511 ohms, 1/8 watt, CPN 705-6266-00.
Radio Frequency Amplifier AM-2061/URT	261		Deleted 2 each tube duct, CPN 543-0456-003. Added 2 each tube duct, CPN 544-9112-003; 2 each tube clamp, CPN 544-9113-003.
		882	C49 changed to CPN 241-0325-00.
	360	801	New interlock switch (S10) actuating arm, CPN 543-0378-002.
	360	801	Switch S10 adjusted so that the switch plunger protrudes 0.250 ±1/32 inch beyond the surface of the rear cover. 4CX250B (V3 and V4) changed to 7580 type tubes.
	662	1249	Revised K~~1~~2 for grid-block keying.
18 December 1961			
	822	1568	Added R39, 270K, 1/2 watt, CPN 745-1454-00. Added CR4, 1N198, CPN 353-0160-00. Rewired K2.
1 November 1962			
		1770	Rerouted wire, was S9 to C63, now to C68, for TEST KEY. See related revision in Interconnecting Box J-1007/U at 1 November 1962.
		1825	L4 and L10 changed for more rugged end stops. L4 was CPN 980-0110-00, now CPN 980-0140-00. L10 was CPN 980-0112-00, CPN 980-0141-00.

TABLE 1-6. (Continued)

UNIT	SERIAL NO. OF FIRST RADIO TO RECEIVE MODIFICATION	MCN OF FIRST UNIT TO RECEIVE MODIFICATION	MODIFICATION
AN/URC-32A Serial No. 1		1834	Improved bias circuit; CR1 now 1N1095, was 1N1084; C53 was 20 uf/150 volts, now 24 uf/200 volts; R18 was 5600/2 volts, now 4000/3 volts. Added alc circuits. Added screen tap switches S11 and S12 and resistors. 7580 tubes deleted, 4CX250R/7580W tubes added, CPN 245-0141-00. XV3 and XV4 tube sockets replaced by improved sockets, CPN 220-1516-00.
Control-Power Supply C-2691/URC	333		Added transformer, CPN 677-1446-00. Added transformer bracket, CPN 546-4035-002. C1 and C2 changed to CPN 184-0763-00, same value, insulated case.
1 November 1962 . . .	. . .	. . .	. . .
AN/URC-32A	Serial No. 1		CR1 - CR4 was 1N1084, now 1N1095.
Power Supply PP-2154/U (Cont)	286		Discriminator heater modification in stabilized master oscillator (SMO). Disconnect ground wire connected to J2, pin 15. Add wire from T1, pin 7 to J2, pin 15. **Note** The SMO discriminator heater modification on the PP-2154/U should be accomplished at the same time the SMO discriminator heater modification is accomplished on the CV731/URC to give the desired results. (A PP-2154/U with the SMO discriminator heater modification will have MOD A stamped on it.)

TABLE 1-6. (Continued)

UNIT	SERIAL NO. OF FIRST RADIO TO RECEIVE MODIFICATION	MCN OF FIRST UNIT TO RECEIVE MODIFICATION	MODIFICATION
Power Supply PP-2154/U (Cont)	585	2119	Changed wiring connection. Wire did connect T1-2 to S1-3. Reconnected from S1-3 to T1-4. New connection allows T1 to be connected to 230 volts ac.
1 November 1962			
AN/URC-32A	Serial No. 1	3034	CR1 - CR5 and CR8 were 1N1084, now 1N1095.
Signal Comparator CM-126/UR	91		R7 changed to 1470 ohms, 1/2 watt, CPN 705-7264-00.
18 December 1961			
		1408	R4 changed to 47 ohms, 1/2 watt, CPN 745-1296-00.
Power Supply PP-2153/U	329		F2, Slo-Blo, changed to normal Blo, CPN 264-4021-00.
	360	801	F1, 20 amp, changed to 15 amp, CPN 264-0005-00.
	360	801	F1, 10 amp for 220-volt operating changed to 8 amp, CPN 264-0002-00.
	631	1191	F3 changed to Slo-Blo CPN 264-0413-00.
	665	1299	CR1 through CR44 changed to 1N1095 diodes, CPN 353-1547-00. Added C3 and C4, 5000 uuf/3000 volts, CPN 913-3533-00. Added C5 through C48, 2200 uuf/500 volts, CPN 913-1192-00.
Air Duct (part of Electrical Equipment Rack MT-2092/U)	360		There are now two air duct valves feeding air to the power amplifier (AM-2061/URT).
Converter-Oscillator CV-731/URC (Cont)	113		Post, CPN 543-3153-00, changed to CPN 545-7747-002. Post, CPN 543-3170-002, changed to CPN 545-7748-002.

TABLE 1-6. (Continued)

UNIT	SERIAL NO. OF FIRST RADIO TO RECEIVE MODIFICATION	MCN OF FIRST UNIT TO RECEIVE MODIFICATION	MODIFICATION
Converter-Oscillator CV-731/URC (Cont)			Post, CPN 543-3179-002, changed to CPN 545-7749-002.
			Post, CPN 543-3156-002, changed to CPN 545-7741-002.
			Post, CPN 543-3174-002, changed to CPN 545-7746-002.
			Gear C, CPN 543-3173-002, changed to CPN 545-7745-002.
			Gear B, CPN 543-3155-002, changed to 545-7740-002.
			Gear F, CPN 543-3158-002, changed to 545-7743-002.
			Shaft, CPN 543-3139-002, changed to 545-7584-002.
			Added 6 each, bearings, CPN 309-0661-00; 2 each, retainers, CPN 45-7585-002.
	286		SMO discriminator heater modification. Disconnect wire from C4 which goes to J7, pin 4, and connect to C3. **Note** The SMO discriminator heater modification on CV-731/URC should be accomplished at the same time SMO discriminator modification is accomplished on FP-2154/U to give desired results. A CV-731/URC SMO discriminator heater modification will have MOD A stamped on it.
	322		R1, R2, R3, and R4, 150 ohms, 1 watt, changed to 470 ohms, 1 watt, CPN 745-3338-00.
	347		L17, 17 mh, CPN 240-0272-00, and C45, 0.02 uf/300 volts, CPN 912-2747-00, added. Add MOD B stamp to CV-731/URC chassis.

TABLE 1-6. (Continued)

UNIT	SERIAL NO. OF FIRST RADIO TO RECEIVE MODIFICATION	MCN OF FIRST UNIT TO RECEIVE MODIFICATION	MODIFICATION
Converter-Oscillator CV-731/URC (Cont)			
Frequency divider module		1801	C3, 1500 uuf, changed to 2000 uuf, CPN 912-1931-00. R5, 23,700 ohms, 1/4 watt, changed to 19,600 ohms, 1/4 watt, CPN 705-4501-00. Added R2, 4700 ohms, 1/2 watt, CPN 745-1382-00. R18, 2200 ohms, 1/2 watt changed to 2700 ohms, 1/2 watt, CPN 745-1369-00.
Sidestep oscillator module		1801	Modification A: Final test selected value of R19 was 18,000 ohms, 1/2 watt, CPN 745-1405-00. Choice of values for R15 changed to include 18,000 ohms, 1/2 watt to 82,000 ohms, 1/2 watt. R16 100,000 ohms, 1/2 watt, CPN 745-1436-00, added. Modification B: C1, 10 uuf, changed to 33 uuf, CPN 912-1797-00. C7, 0.01 uf, changed to 0.033 uuf, CPN 931-5297-00. C9, 0.01 uf, changed to 6800 uuf, CPN 931-9094-00. R2, 68,000 ohms, 1/2 watt, changed to 33,000 ohms, 1/2 watt, CPN 745-1415-00. Modification C: R22, 27,000 ohms, 1/4 watt, CPN 745-0800-00 added across C25. Modification D: C27, 0.033 uf, changed to 200 uuf, CPN 912-1854-00.
		2842	C26 value selected from 56 uuf, CPN 912-1814-00, to 62 uuf, CPN 912-1817-00.
Reference oscillator module (Cont)			Modification A: Changed to modification E.

TABLE 1-6. (Continued)

UNIT	SERIAL NO. OF FIRST RADIO TO RECEIVE MODIFICATION	MCN OF FIRST UNIT TO RECEIVE MODIFICATION	MODIFICATION
Reference oscillator module (Cont)			Modification B: Q13, type 2N118, changed to type J213, CPN 352-0087-00. Modification C: R36, 39,000 ohms, 1/2 watt, changed to 18,000 ohms, 1/2 watt, CPN 745-1405-00. Modification D: R20, 22,000 ohms, 1/2 watt, changed to 10,000 ohms, 1/2 watt, CPN 745-1394-00. Modification E: Q3, type 2N525, changed to type 2N527, CPN 352-0124-00. Q1, Q2, and Q4, type 2N538, changed to type 2N540, CPN 352-0026-00. Modification F: R2, 47 ohms, 1/2 watt, changed to 100 ohms, 1/2 watt, CPN 745-1310-00. Tie emitters of Q2 and Q4 together. Modification G: Add diodes CR1 and CR2, type 1N91, CPN 542-7742-005. Modification H: R6, 22 ohms, 2 watts, changed to 5 ohms, 2 watts, CPN 747-5314-00. Modification J: Add CR3, type 1N721A, CPN 353-2741-00. Add R40, 33,000 ohms, 1/4 watt, CPN 745-0803-00. R29, 12,000 ohms, 2 watts, changed to 7500 ohms, 5 watts, CPN 747-9399-00.

TABLE 1-6. (Continued)

UNIT	SERIAL NO. OF FIRST RADIO TO RECEIVE MODIFICATION	MCN OF FIRST UNIT TO RECEIVE MODIFICATION	MODIFICATION
Reference oscillator module (Cont)		1801	Modification K: Add R40, 2200 ohms, 1/2 watt, CPN 745-1366-00.
		3374	Q5 through Q12 changed to type 2N499, CPN 352-0091-00.
		3745	C37 changed to 8200 uuf, CPN 931-5035-00.
		3815	C35 value selected, 0.0047 to 0.01 uf.
18 December 1961 . . .	. . . .	. . . .	. . . .
		4061	C23, C27 changed to 3300 uuf, CPN 913-3025-000.
			C29 changed to 680 uuf, CPN 914-0547-000.
Stabilized master oscillator module (Cont)	360		Add R33, 22,000 ohms, 1/2 watt, CPN 745-1408-00. Starting with serial No. 360, the AN/URC-32 has a new SMO. The new SMO is CPN 528-0021-005 and is marked MODEL B.
		Model B 152	C27, 22 uuf, changed to 51 uuf, CPN 912-1812-00.
		Model B 307	C9 on i-f amplifier and discriminator board changed to 160 uuf, CPN 912-1848-00.
		Model B 307	C34 on i-f amplifier and discriminator board changed to 240 uuf, CPN 912-1860-00.
	639	Model C 101	R7 on meter amplifier board changed to 6190 ohms, CPN 705-7134-00. Model C SMO is CPN 528-0176-00. The second and third mixer board were changed to CPN 547-3766-004. SMO with this modification are marked MODEL C.

TABLE 1-6. (Continued)

UNIT	SERIAL NO. OF FIRST RADIO TO RECEIVE MODIFICATION	MCN OF FIRST UNIT TO RECEIVE MODIFICATION	MODIFICATION
Stabilized master oscillator module (Cont)		Model B 870	Resistor R29 and r-f tuner chassis changed to 15,000 ohms, 1/2 watt, CPN 745-1401-00.
		Model C 153	R3 and R8 on second and third mixer board changed to 470 ohms, CPN 745-1338-00.
		Model C 371	CR2 in reference i-f board changed to type 1N270, CPN 353-2018-00.
R-f tuner module (Cont)	137		Chassis part no. changed to CPN 544-2772-004. Coil Z18 changed to CPN 544-2765-003. Coil Z19 changed to CPN 544-2766-003. Coil Z20 changed to CPN 544-2767-003.
	116		Added choke L34, CPN 240-0198-00. Added choke L33, CPN 240-0313-00. Added C183, CPN 913-3159-00. Added R65, CPN 745-5701-00. Deleted R14, CPN 745-1436-00.
	360		Starting with serial No. 360, the AN/URC-32 has a new r-f tuner. The new r-f tuner is CPN 546-2148-005 and is marked MODEL B.
		651	Modification B: Deleted C170, CPN 184-7228-00; R61, CPN 745-3324-00; wire from P2-5 to K2-8; and wire from P2-22 to K2-1. Added R67, CPN 747-1712-00; connected R67 between K2-8 and 130-volt d-c transmit; ground K2-1.
		101	C146 changed to CPN 913-2986-00; was 1.5 uuf, now is 2.4 uuf.

TABLE 1-6. (Continued)

UNIT	SERIAL NO. OF FIRST RADIO TO RECEIVE MODIFICATION	MCN OF FIRST UNIT TO RECEIVE MODIFICATION	MODIFICATION
R-f tuner module (Cont)		175	Part numbers changed. No change in values or interchangeability: Symbol No. — New CPN C27 — 913-2988-00 C5 — 913-2991-00 C8 — 913-2991-00 C15 — 913-2991-00 C21 — 913-2991-00 C37 — 913-2997-00 C32 — 913-2977-00 C66 — 913-2981-00 C70 — 913-2981-00 C145 — 913-2984-00 C184 C139 — 913-2984-00 C114 — 913-2984-00
	360	101	C61 changed to CPN 913-3161-00; 10,000 uuf changed to 1000 uuf.
		1185	Style of motor-shaft coupling, MP11, changed to CPN 548-1284-002.
18 December 1961	. . . .	. . . .	. . . .
	882	1762	CR2, CR3 added, 1N457 CPN 353-0204-000. K2 wiring changed.
Converter-Monitor CV-730/URC		1150	Diodes A1CR1, CR2, and CR3 changed to type 1N198, CPN 353-0160-00. Diode CR4 changed to type 1N1489, CPN 353-1658-00. Added CR6, type 1N198, CPN 353-0160-00. Added C27, CPN 931-4607-00, and R30, CPN 745-3303-00, to suppress arcing between contacts of relay K1.
Electronic Equipment Air Cooler HD-347/U	882	1680	Added cleaning instructions to front cover.
AN/URC-32	360		Knobs of type used on the sideband selector switch now have a white line across top extending in direction of pointer on the knob. The new knob part number is CPN 547-1380-00.

TABLE 1-6. (Continued)

UNIT	SERIAL NO. OF FIRST RADIO TO RECEIVE MODIFICATION	MCN OF FIRST UNIT TO RECEIVE MODIFICATION	MODIFICATION
1 November 1962	. . . .	. . . .	. . . .
AN/URC-32A	1		Deleted AM-2062/URC. Added AM-2062A/URC (with AM-3198/URC line amplifiers). AM-2061/URT revised by improving bias circuit, adding alc circuit, adding screen tap switches, deleting 7580, and adding 4CX250R/7580W. Diodes 1N1084 replaced by 1N1095 diodes in low-voltage power supply, power amplifier, and handset adapter.
AN/URC-32B			Added 0.1-kc tuning module, chassis plug, wiring, and new cover to CV-731/URC.

1-9. FIELD CHANGES.

Table 1-7 lists the field changes made on units used in the AN/URC-32( ). Refer to NAVSHIPS 900,000, Electronics Installation and Maintenance Book (EIMB), for the complete field change identification guide index.

1-10. EQUIPMENT SIMILARITIES.

Radio Set AN/URC-32( ) equipments are very similar with almost no change in external physical appearance. The AN/URC-32( ) is divided into three categories: the AN/URC-32, AN/URC-32A, and AN/URC-32B. This manual provides complete instructions for installing and operating all AN/URC-32( ) equipments. Maintenance instructions are supplied for the AN/URC-32A and AN/URC-32B only; however section 5 contains schematics and pictorial parts illustrations for the AN/URC-32( ).

a. RADIO SETS AN/URC-32 AND AN/URC-32A. - The AN/URC-32A is the same as the AN/URC-32 except for the differences listed below.

(1) An automatic load control (ALC) adjustment (accessible through the front panel of the AM-2061/URT) is included.

(2) Switches are provided to adjust the screen-grid voltages of the power amplifier tubes (accessible through the rear panel of the AM-2061/URT).

(3) The microphone jack on the front panel of the AM-2062A/URC and the internal microphone circuitry have been removed.

(4) New PA tube sockets are provided to reduce humidity failure.

(5) A new amplifier AM-3198/URC interchangeable with the older 356C-1 module has been added to the AM-2062A/URC for more optimum independent-sideband operation.

b. RADIO SETS AN/URC-32A AND AN/URC-32B. - The AN/URC-32B is the same as the AN/URC-32A, except that the AN/URC-32B contains a 0.1-kc tuning module with an operating control accessible on the front panel of the CV-731/URC.

c. SIMILARITY WITH COLLINS RADIO COMPANY TRANSCEIVER KWT-6 TYPE 8. - Sufficient similarity exists between the AN/URC-32( ) Series and Transceiver KWT-6 Type 8 for this manual to be used in support of the latter equipment.

1-11. PREPARATION FOR RESHIPMENT.

Radio Set AN/URC-32( ) equipments should receive special attention when being prepared for reshipment. The base should be bolted to the base of an applicable wooden crate (preferably the original shipping crate). The top sides of the rack also should be firmly secured to the crate frame. If storage or shipment through high humidity conditions is anticipated, the AN/URC-32( ) should be sealed in a moisture-tight plastic film bag with sufficient desiccant (silica gel) added for further protection. The equipment should be shipped in a vertical position to prevent damage.

TABLE 1-7. FIELD CHANGES ON THE AN/URC-32( )

AN/URC-32 FIELD CHANGE NO. AND SERIAL NO. EFFECTIVITY	UNITS AFFECTED	BRIEF DESCRIPTION OF CHANGE	ELECTRONICS INFORMATION BULLETIN NO.	NAVSHIPS PUBLICATION
1 (Serial No. 1 thru 359)	Interconnecting Box J-1007/U	Added thermal relay to protect receiver input from currents exceeding 100 ma.		
	Converter-Oscillator CV-731/URC	Power source for discriminator oven changed to ac. Dial lamp resistors changed to 470 ohms.		
	Power Supply PP-2154/U	Added 35-volt a-c power source for discriminator oven in CV-731/URC.		
	Amplifier-Converter-Modulator AM-2064/URC	Ties manual gain control to receiver i-f amplifiers; added silk-screened TUNE-LOCAL-EXTERNAL CONTROL.		
	Radio Frequency Amplifier AM-2061/URT	Replaced spring washer in turns-counting knobs; adjusted chassis interlock switch for new bracket.		
	Amplifier-Control AM-2062/URC	Allows monitoring audio with headphones without disrupting speaker audio output.		
	Control-Power Supply C-2691/URC	Added isolation transformer for balanced audio input lines.		
	Electrical Equipment Rack MT-2092/U	Added improved interlock bracket behind AM-2061/URT.		
2 (Serial No. 1 thru 631)	Power Supply PP-2153/U	Replaced high-voltage fuse F3 with sand-packed type fuse.	557	981323
3 (Serial No. 1 thru 627)	Interconnecting Box J-1007/U	Wiring changed to interlock power amplifier and high-voltage power supply thru blower air interlock switch.	558	981324
4 (Serial No. 1 thru 584	Power Supply PP-2154/U	Corrected transformer T1 wiring for proper 230-volt operation.	559, 561	981325
5 (Serial No. 1 thru 662	Radio Frequency Amplifier AM-2061/URT	Modified power amplifier keying from screen voltage to grid-block keying.	561, 565, 570	981341

TABLE 1-7. (Continued)

AN/URC-32 FIELD CHANGE NO. AND SERIAL NO. EFFECTIVITY	UNITS AFFECTED	BRIEF DESCRIPTION OF CHANGE	ELECTRONICS INFORMATION BULLETIN NO.	NAVSHIPS PUBLICATION
6 (Serial No. 1 thru 359)	Radio Frequency Amplifier AM-2061/URT	Added additional air hole to rear plate for increased air cooling of power amplifier tubes.	568	981384
	Electrical Equipment Rack MT-2092/U for Air Duct	Added additional hole and air valve to supply more air to power amplifier.		
7 (Serial No. 1 thru 690)	Converter-Monitor CV-730/URC	Added isolating diode to FSK input to protect circuit when reversed polarity FSK erroneously applied; added relay contact arc suppressing filter.	580	981474
8 (Serial No. 1 thru 822) ------------ 1 For KWT 6-8 for serial No. 1 thru 79	Radio Frequency Amplifier AM-2061/URT	Added resistor and diode to keying circuit for cleaner keying.	580	981475
9 (Serial No. 1 thru 900) ------------ 2 For KWT 6-8 for serial No. 1 thru 88.	Power Supply PP-2153/U	Added ground wire to interlock switch for added protection.	584	981476
10 (Serial No. 1 thru 881)	R-f tuner module in CV-731/URC	Added two diodes and rewired K2 for keying transient elimination.		981584
11 (All serial No.)	Radio Set AN/URC-32	Directions for use of AN/URC-32 with AN/WRA-3		981487
12 (All serial No. up to AN/URC-32A No. 100) ------------ 3 For KWT 6-8 for serial No. 1 thru 90	Radio Frequency Amplifier AM-2061/URT	Changed R22 from 27K to 68K ohms to increase cutoff bias of V1 and V2.		

TABLE 1-7. (Continued)

AN/URC-32 FIELD CHANGE NO. AND SERIAL NO. EFFECTIVITY	UNITS AFFECTED	BRIEF DESCRIPTION OF CHANGE	ELECTRONICS INFORMATION BULLETIN NO.	NAVSHIPS PUBLICATION
13 (Serial No. 1 thru 981) ------------ 4 For KWT 6-8 for serial No. 1 thru 90	Control-Power Supply C-2691/URC Power Supply PP-2154/U	Changed 1N1084 diodes to type 1N1095.		981638
14 (Serial No. 1 thru 664) ------------ 5 For KWT 6-8 for serial No. 1 thru 90	Power Supply PP-2153/U	Changed 1N1084 diodes to type 1N1095.		981639
15 (Serial No. 1 thru 981) ------------ 6 For KWT 6-8 for serial No. 1 thru 90	Interconnecting Box J-1007/U	Added jumper for 35 volts ac to vswr protector.		
16 (Serial No. up to AN/URC-32A No. 100) ------------ 7 For KWT 6-8 for serial No. 1 thru 90	Radio Frequency Amplifier AM-2061/URT	Removed jumper on driver tube sockets to eliminate oscillation by some 6CL6 tubes.		

SECTION 2

INSTALLATION

2-1. UNPACKING AND HANDLING.

Exercise care in unpacking to prevent damage. Use adequate lifting and transport gear. Set the crate in the position indicated by crate markings before opening. Use a nail puller to remove nails, not a bar or other tool which may damage equipment.

Check the equipment shipped against the packing list and the list of equipment supplied (table 1-3). Check for internal damage; then determine that all the tubes in the equipment are in place. Immediately report any shortage of material or damaged parts.

2-2. POWER REQUIREMENTS.

Radio Set AN/URC-32( ) can be operated from a primary power source of 115 or 230 volts, 60 cps, single phase. The unit is connected for 115-volt a-c operation when shipped; if 230-volt operation is desired, it is necessary that primary connections of transformers be reconnected. The primary power distribution diagram is shown in section 5, figure 5-89.

The transceivers require 1000 watts on receive (standby) and 1500 watts on transmit.

2-3. SITE SELECTION. - (Refer to figure 2-5.) The selected location should provide sufficient space and light to operate and maintain the equipment properly. Remember that sufficient space is required in front of the equipment to allow individual units to be extended or removed from the mounting rack.

2-4. INSTALLATION REQUIREMENTS.

a. BUREAU OF SHIPS INSTALLATION. - The latest approved Bureau of Ships installation plans should be used for installation of this equipment. The installing personnel should be familiar with the operation of Radio Set AN/URC-32( ).

b. GENERAL. - The equipments are shipped with all units mounted on one rack. Power Supply PP-2153/U is mounted on the back of the rack, and the remaining units are mounted on the front (see figures 1-1 and 1-12). The vibration and shockmount is packed separately. When required, Electrical Equipment Installation Kit MK-446A/URC-32 may be ordered separately (used to mount Power Supply PP-2153/U on the bulkhead independent of the transceiver rack).

The AN/URC-32( ) equipments can be installed in one of two configurations. The basic installation is one in which all units are mounted on one rack; access is required to the rear of the rack to service Power Supply PP-2153/U. Installation types 1 and 2 shown in figure 2-5 are typical examples of the basic installation. When no access is required at the rear of the equipment, either installation type 3 or 4 can be used; these types of installation require removal of Power Supply PP-2153/U from the rear of the rack and mounting on the bulkhead using Electrical Equipment Installation Kit MK-446A/URC-32.

The AN/URC-32( ) equipments operate from a self-contained frequency standard. Use of an external frequency standard, such as the AN/URQ-9 as the equipment standard, requires replacement of the reference oscillator in Converter-Oscillator CV-731/URC with accessory unit Isolation Amplifier Module AM-1785/GRC. When this conversion is made, two AM-1785/GRC units should be requisitioned, one for substitution in the CV-731/URC and a spare for Electrical Equipment Maintenance Kit MK-447/URC-32. The external frequency standard must supply a 1.3-volt signal in 100 kilohms (the connection is made at J14 at the rear of the CV-731/URC). When it is desired to only use the AN/URQ-9 source, the AM-1785/GRC units are not required, and the AN/URQ-9 is then connected to the AN/URC-32( ) Signal Comparator CM-126/UR.

When the transceivers are shipped, a blank space (located below Interconnecting Box J-1007/U) is provided for mounting either Coupler Monitor CU-737/URC or Coupler Control C-2698/SRA-22 (a part of the Antenna Coupler Group AN/SRA-22). All cables and connectors necessary to connect either of these units in the rack are supplied with the AN/URC-32( ). Coupler Monitor CU-737/URC provides all necessary tuning with a 50-ohm termination and minimum voltage-standing-wave ratio (vswr) for Radio Frequency Amplifier AM-2061/URT. When Antenna Tuner AN/BRA-3, AN/BRA-5, AN/BRA-13, AN/BRA-17, AN/SRA-18, or a 50-ohm multicoupler is used, it is necessary to use Coupler Monitor CU-737/URC. Both the CU-737/URC and the C-2698/SRA-22 contain a directional wattmeter, an antenna transfer relay, and a switch for selecting a dummy antenna. The CU-737/URC also contains a loud speaker.

c. ELECTRICAL EQUIPMENT RACK MT-2092/U INSTALLATION.

(1) Secure the base shockmount to the deck and the rear stabilizer to the bulkhead or overhead bracket (in shipboard or vehicular installations). (See figure 2-6 or 2-7 for the dimensions required to locate and mount the shockmount and stabilizer.) Mounting holes are provided in the shockmount for four 1/2-inch bolts. The shockmount should be secured to studs welded to the deck or to a steel foundation. If the steel foundation provides support only at opposite ends of the shockmount, weld a 1/2-inch steel plate to the steel foundation, and then fasten the shockmount to the steel plate. Mounting holes also are provided in the stabilizer for eight 1/4-inch bolts. When the equipment is flush mounted (with the high-voltage power supply removed from rear of

the rack), the stabilizer can be secured to a cross brace which has been welded to the bulkhead stiffeners. When the high-voltage power supply is to be mounted on the rear of the rack, the stabilizer may be secured to the bulkhead using a 3-inch steel pipe between bulkhead and stabilizer for support.

(2) Remove all units from the rack except Interconnecting Box J1007/U, Electronic Equipment Air Cooler HD-347/U and adjoining duct work, and Power Supply PP-2153/U. Start with Radio Frequency Amplifier AM-2061/URT and work down the rack. To each unit, remove the screws that fasten the right side of the unit to the rack, swing the unit out on its hinge, disconnect the electrical connectors, and remove the two screws that fasten the unit hinge to the rack.

(3) Remove the cover from Power Supply PP-2153/U by pressing on the thumb-release fasteners. Loosen the four screws that fasten the left side to the rack (do not remove these screws). Remove from the rack by removing the four screws that fasten the right side to the rack. The high-voltage power supply weighs 93 pounds, so it should be blocked up or held up by a second person when the screws are removed.

(4) Disconnect the coaxial connector from J1 on the rear of the power supply, and remove the cover from terminal board TB1; then disconnect the multiwire cable from TB1, and record the wire color code and terminal number. Remove cable clamp. (Clamp is fastened with nut and washer inside unit.)

(5) Refer to figure 2-1. Disconnect plug (item 2) from J1 on Electronic Equipment Air Cooler HD-347/U (blower), remove the two screws (item 3) that fasten the front of the air duct to the unit. Loosen the two screws (item 1) that fasten the rear of the aid duct to the HD-347/U, slide air duct forward, and remove the two screws.

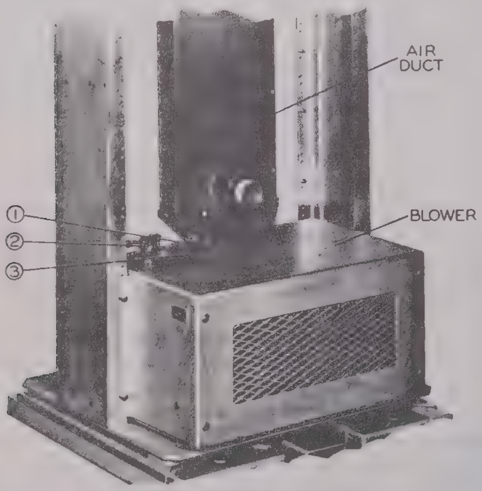


Figure 2-1. Rack Mounting of Electronic Equipment Air Cooler HD-347/U

(6) Loosen two screws that fasten left side to the rack (do not remove these two screws). Remove two screws that fasten right side of the HD-347/U to the rack and slide unit out of the rack.

(7) Refer to figure 2-2. Remove 3/8-16 volts (item 1) that fasten rack side channels to the base angle bracket. Holding the rack upright, remove the six 3/8-16 bolts (item 3) that fasten the side angle bracket to the base. Lift rack from base and set rack on the shockmount. Fasten rack channels to the stabilizers using eight 12-24 screws and lock washers.

(8) Fasten side channels to the base angle bracket using the four 3/8-16 bolts (item 1) and washers removed in step (7). It may be necessary to loosen the screws (item 2) that fasten the side channel angle bracket to the side channels.

(9) Fasten the side channel angle brackets to the base using the six 3/8-16 bolts (item 3) and washers removed in step (7).

Note

Number 12 captive nuts, screws, and washers are provided in Electrical Equipment Maintenance Kit MK-447/URC-32 for fastening the major units to the rack in case the threads are stripped from the rack mounting holes. If the rack mounting hole thread is stripped, drill out to a diameter of 0.312 inch, and press captive nut into the hole from the inside of the rack.

(10) Position Electronic Equipment Air Cooler HD-347/U in the rack with air opening under the air duct. Fasten right side to the rack using the two screws removed in step (6). Tighten the two screws that fasten the left side of the HD-347/U to the rack.

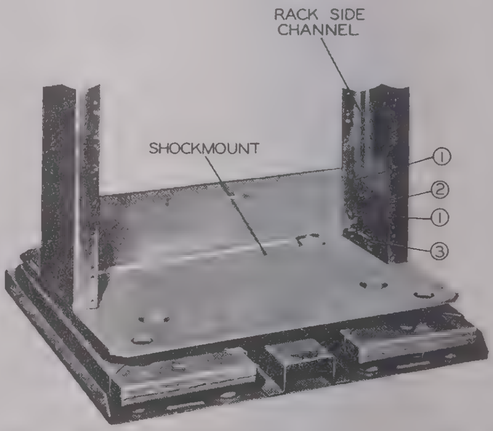


Figure 2-2. Base Shockmount Installation

(11) Pull the air duct forward, and install the two hexhead screws that fasten rear of the air duct to the blower (do not tighten screws). Push air duct to the rear and fasten front of air duct to the blower using screw removed in step (5). Tighten hexhead screws that fasten rear of air duct to the blower (HD-347/U), and connect plug marked HD-347/U to J1.

Note

Multiple wire cable plugs are marked by a band (fastened to the cable adjacent to the plug) containing the unit type number (or in the case where a unit has more than one plug, with the unit type number and a plug number corresponding to the jack number). When more than one multiple connector is used on a unit, the plugs are keyed so that they fit only one jack on that unit.

Note

Steps (12) and (13) are performed only when Power Supply PP-2153/U is to be mounted on the basic rack. When the PP-2153/U is to be mounted with Electrical Equipment Installation Kit MK-446A/URC-32, the procedure in paragraph 2-4d is to be followed before proceeding to step (14).

(12) Connect PP-2153/U multiwire cable to terminal board TB1 using the wire color code versus terminal number recorded in step (3). Fasten cable to PP-2153/U chassis using cable clamp removed in step (4). Replace cover over TB1. Connect coaxial plug to J1 on the unit.

(13) Slide left side of PP-2153/U on to the mounting screws that were loosened in step (3). Fasten right side to rack using screws removed in step (3). Tighten screws on the left side, slide cover over the unit and secure by pressing on thumb-release fasteners.

(14) Mount the remainder of the units on the rack starting at the bottom of the rack and working up. See figures 1-1 and 2-6 for proper location of units. To mount each unit, fasten unit hinge to the left side of the rack using the screws and washers removed in step (3); connect cable plug to unit jacks, swing unit in on hinge, and fasten right side of unit to the rack using the screws and washers removed in step (3).

d. PROCEDURE FOR INSTALLING ELECTRICAL EQUIPMENT INSTALLATION KIT MK-446A/URC-32. - The following procedure replaces steps (12) and (13) of paragraph 2-4c when Power Supply PP-2153/U is mounted to the bulkhead using Electrical Equipment Installation Kit MK-446A/URC-32. This kit consists of a bulkhead mounting bracket, a terminal box, and two UG-925A/U coaxial connectors. The procedure consists of securing the bulkhead mounting bracket to the bulkhead, mounting the terminal box on the AN/URC-32( ) rack, making the necessary electrical connections, and mounting Power Supply PP-2153/U to the bulkhead mounting bracket. Figure 2-3 shows the location of the terminal box on the AN/URC-32( ) rack, and figure 5-123 shows the electrical connections.

(1) Mount the terminal box (part of MK-446A/URC-32) on the AN/URC-32( ) rack using four 8-32 screws and four No. 8 washers in the sack attached to the terminal box. (See figure 2-3 for location of terminal box.)

(2) Secure bulkhead mounting bracket either by tack welding directly to the bulkhead stiffeners or tack welding a mounting plate to the bulkhead stiffeners with the bulkhead mounting bracket secured to this plate using 3/8-inch-diameter bolts or tack welding. See figure 2-7 for outline and mounting dimensions. The bracket must be mounted with the coaxial connector on the left side.

(3) Remove the cover from the terminal board. Connect the cable which was removed from TB1 on Power Supply PP-2153/U (step (4) of paragraph 2-4c) to the terminal board on the terminal box. (See W25 on figure 5-91.)

(4) Install two cables, MSCA-7 and DSGA-9, from the terminal box to TB1 on Power Supply PP-2153/U (see figure 5-91). Clamp cables near each terminal board and replace cover over each terminal board.

(5) Fabricate cable from RG-8/U coaxial cable and the two UG-925A/U connectors supplied in a sack attached to the high-voltage power supply

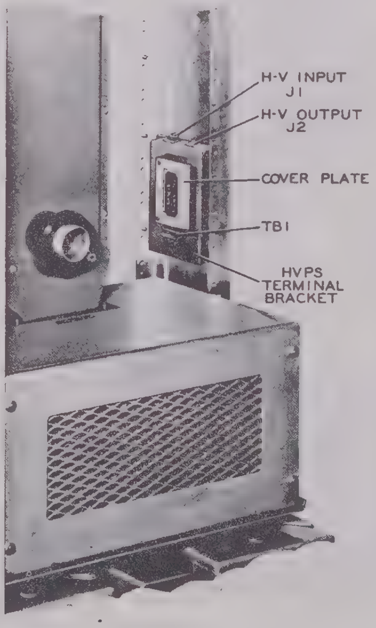


Figure 2-3. Location of Power Supply PP-2153/U Bulkhead Mounting Terminal Box

bulkhead mounting kit (see figure 2-8). Connect cable from H-V INPUT connector on terminal box to the coaxial jack on the bulkhead mounting bracket.

(6) Mount power supply on the bulkhead mounting bracket using the eight No. 12 screws and washers removed in step (3) of paragraph 2-4c.

(7) Connect the coaxial plug on the bulkhead mounting bracket to J1 on Power Supply PP-2153/U.

e. CONNECTIONS TO REMOTE CONTROL POSITIONS. - Figure 5-92 shows the cabling connections to typical remote control positions. These connections are made through the transmitter and receiver switchboards to any combination of these remote control positions. All connections to the AN/URC-32( ) are made to terminal boards in Interconnecting Box J-1007/U. Provisions for stop and start of the equipment are not available from the remote control positions. The transceivers are energized locally at the equipment rack and are on continuously when continued operational use is required. The AN/URC-32( ) equipments are provided with Dynamic Handset H-169/U, which incorporates a noise-canceling dynamic microphone and a transistor amplifier. The preferred H-169/U is directly interchangeable with the NT-51007A carbon-type handset.

f. CONNECTIONS TO COUPLER CONTROL C-2698/SRA-22. - The C-2698/SRA-22 is accessory equipment which, if used, is mounted on the rack below Interconnecting Box J-1007/U (see figure 1-1). The unit is part of Antenna Coupler Group AN/SRA-22; the other unit in this group, Antenna Coupler CU-714/SRA-22, is mounted at the antenna location. Figure 5-96 shows the connections between the C-2698/SRA-22 and the CU-714/SRA-22, and components of the AN/URC-32( ). The cables and connectors for this connection are supplied with the AN/URC-32( ). If the C-2698/SRA-22 is installed, be sure that the following jumper wires are connected in Interconnecting Box J-1007/U from TBJ-10 to TBH-9, TBJ-15 to TBJ-16, and TBJ-14 to TBH-8. These jumper wires, which are factory installed, may have been removed in previous installations when the AN/URC-32 was used with AN/BRA-3, AN/BRA-5, AN/BRA-13, or AN/BRA-17 type submarine antenna coupler.

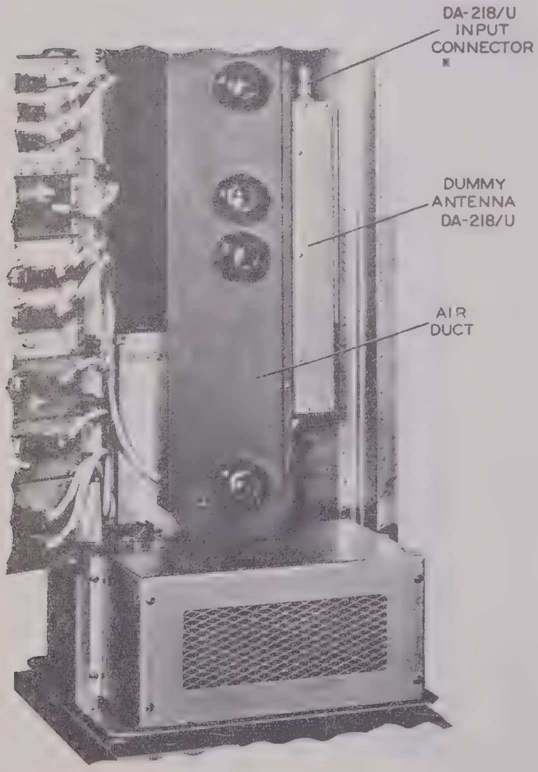


Figure 2-4. Mounting Location of Electrical Dummy Load DA-218/U

When the AN/SRA-22 is used, a local speaker may be installed if desired. Connect a 4-ohm speaker to TBG-3 and TBG-4, or a 600-ohm speaker to TBG-5 and TBG-6 in Interconnecting Box J-1007/U. In either case, remove the 680-ohm resistor from TBG-5 and TBG-6. Reconnect the resistor when the speaker is removed.

g. CONNECTIONS TO COUPLER MONITOR CU-737/URC. - The CU-737/URC is an accessory equipment which must be used with the AN/URC-32( ) if Antenna Tuner AN/BRA-3, AN/BRA-5, AN/BRA-13, AN/BRA-17, AN/SRA-18, or a 50-ohm multicoupler is used. The CU-737/URC, if used, mounts on the rack below Interconnecting Box J-1007/U (see figure 1-1). Figure 5-95 shows the connections to the CU-737/URC and Electrical Dummy Load DA-218/U. The cables and connectors for connecting the CU-737/URC are supplied with the AN/URC-32( ). If the CU-737/URC is installed with the AN/BRA-3 type submarine antenna tuner, remove the following jumper wires in Interconnecting Box J-1007/U: from TBJ-10 and TBH-9 and from TBH-15 and TBH-16.

The CU-737/URC provides a speaker for local operation; when the speaker is used, remove the 680-ohm resistor from TBG-5 and TBG-6 in Interconnecting Box J-1007/U. Reconnect the resistor when the speaker is removed.

h. CONNECTIONS TO EXTERNAL 100-KC FREQUENCY STANDARD. - The following procedure is used when the equipment is supplied with a 100-kc high-stability frequency signal from a ship's frequency standard, such as an AN/URQ-9 instead of from the reference oscillator module of the equipment (refer to paragraph 2-4b).

(1) Remove the dust cover from Converter-Oscillator CV-731/URC. Remove the two screws that fasten the top of the control panel to the chassis. The control panel will then swing down on the frequency change drive shaft and allow access to the reference oscillator module.

(2) Remove the reference oscillator module by loosening the two red captive screws and pulling module from chassis.

(3) Plug Isolation Amplifier Module AM-1785/GRC into the position formerly occupied by the

reference oscillator module, and secure to the chassis with the two red captive screws.

(4) Connect 100-kc input from ship's frequency standard to coaxial connector J14 on the rear of the CV-731/URC.

(5) Adjust 100-kc input for 1.3 volts rms at test point J1 on the AM-1785/GRC.

i. PRIMARY POWER CONNECTIONS. - Radio Set AN/URC-32( ) may be operated from a 115-volt, 60-cps, 2-wire source; a 230-volt, 60-cps, 3-wire source; or a 230-volt, 60-cps, 2-wire source. Radio Set AN/URC-32 is shipped wired for operation on a 115-volt, 60-cps, 2-wire source. See figure 5-89 for primary power distribution.

Note

Before making any power connections to the transceivers, remove fuses from Interconnecting Box J-1007/U.

(1) 115-VOLT, 2-WIRE OPERATION. - Radio Set AN/URC-32( ) is shipped wired for 115-volt, 2-wire operation. Power connections are made to fuse holders in Interconnecting Box J-1007/U (see figures 5-89 and 5-92). Connect a grounding strap from the rack to the main grounding system.

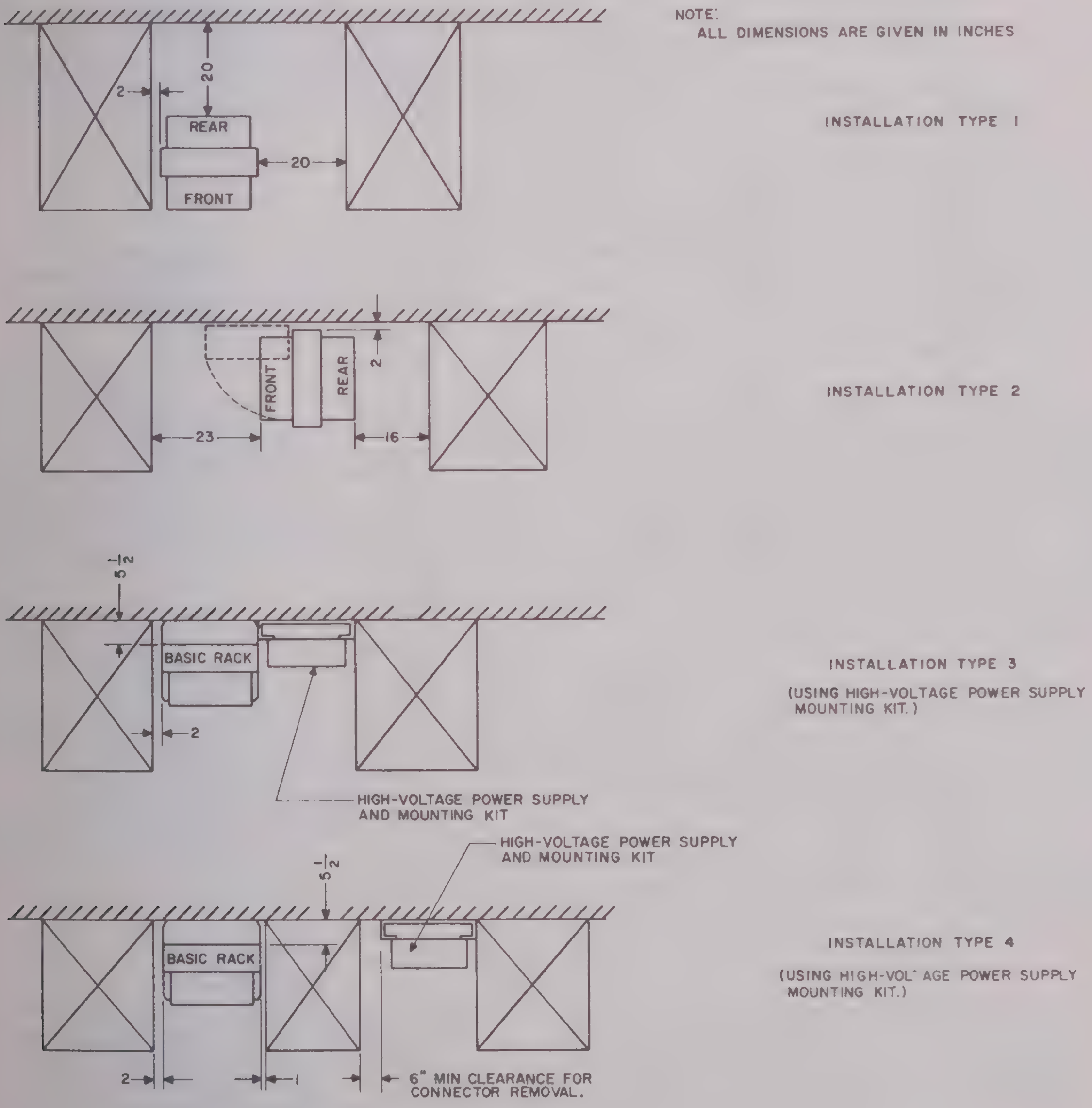

NOTE:
ALL DIMENSIONS ARE GIVEN IN INCHES
20
2
REAR
20
FRONT
INSTALLATION TYPE 1
FRONT
REAR
2
23
16
INSTALLATION TYPE 2
5 1/2
BASIC RACK
2
HIGH-VOLTAGE POWER SUPPLY AND MOUNTING KIT
INSTALLATION TYPE 3
(USING HIGH-VOLTAGE POWER SUPPLY MOUNTING KIT.)
HIGH-VOLTAGE POWER SUPPLY AND MOUNTING KIT
5 1/2
BASIC RACK
2
1
6" MIN CLEARANCE FOR CONNECTOR REMOVAL.
INSTALLATION TYPE 4
(USING HIGH-VOLTAGE POWER SUPPLY MOUNTING KIT.)

Figure 2-5. Typical Installations for Radio Set AN/URC-32( ) Showing Mounting and Clearance Dimensions

(2) 230-VOLT, 3-WIRE OPERATION. - When the transceivers are operated in this manner, Electronic Equipment Air Cooler HD-347/U and Power Supply PP-2153/U are operated from one 115-volt circuit, and the remainder of the units are operated from the other 115-volt circuit (see figure 5-89). This arrangement provides better over-all regulation when several are operated from the same power line. Connect a grounding strap from the rack to the main grounding system.

(3) 230-VOLT, 2-WIRE OPERATION. - To operate on a 230-volt, 2-wire system, see figure 5-89, and reconnect the following for 230-volt operation:

(a) Terminal board TB1 on Electronic Equipment Air Cooler HD-347/U.

(b) Transformer T1 on Power Supply PP-2154/U.

(c) Transformer T1 on Control-Power Supply C-2691/URC.

(d) Transformer T1 on Radio Frequency Amplifier AM-2061/URT.

(e) Transformer T1 on Power Supply PP-2153/U.

Replace 20-ampere fuse F1 in Power Supply PP-2153/U with a 10-ampere fuse. Connect a grounding strap from the AN/URC-32( ) rack to the main grounding system.

2-5. CABLE ASSEMBLIES.

All cables needed for basic installation of Radio Set AN/URC-32( ) (as shown in figure 2-6) are shipped as an integral part of the equipments. When a transceiver is to be flush mounted (see figure 2-7) a coaxial cable must be fabricated to connect the rack to the separately mounted high-voltage power supply (PP-2153/U, see figure 2-3). Figure 2-8 lists the instructions to be followed in fabricating the necessary cable.

2-6. INSPECTION AND ADJUSTMENT.

The following paragraphs contain information on the adjustments, performance checks, and energization of equipment following installation.

a. POWER TURN-ON OF RADIO SET AN/URC-32( ). - The procedure for energizing the equipment for the first time is as follows:

(1) Install the proper fuses in Interconnecting Box J-1007/U (20 amp for 115-volt, 2-wire or 230-volt, 3-wire sources; 10 amp for 230-volt, 2-wire sources).

CAUTION

Electrical Dummy Load DA-218/U must be connected to the r-f output before turning on power or damage to equipment will result.

(2) Set ON-OFF switch on Power Supply PP-2154/U to OFF.

(3) Set FIL OFF-TUNE-OPERATE switch to FIL OFF and PLATE switch to OFF on Radio Frequency Amplifier AM-2061/URT.

(4) Set RECEIVER RF GAIN control on Amplifier-Converter-Modulator AM-2064/URC fully counterclockwise.

(5) Set FREQUENCY SELECTOR switch on Signal Comparator CM-126/UR to OFF.

(6) Set XMIT-REC-XMIT TEST switch to REC and OSC CONTROL switch to OFF on Converter-Monitor CV-730/URC.

(7) Set SIDEBAND SELECTOR switch on Amplifier-Control AM-2062( )/URC to LOCAL OFF.

(8) Set ON-OFF switch on Power Supply PP-2154/U to ON (the indicator lamp will light when air pressure is present in the cooling system).

(9) Set meter selector switch on Amplifier-Converter-Modulator AM-2064/URC successively to the following positions: -90, +130, and +250; meter should register approximately midscale in each position.

Note

When using auxiliary equipments, such as AN/BRA-3, AN/BRA-5, AN/BRA-13, or AN/BRA-17 for a submarine installation, these equipments must be turned on.

(10) Set the FIL OFF-TUNE-OPERATE switch on the AM-2061/URT to OPERATE; wait 30 seconds before performing step (11).

(11) Set the PLATE switch on AM-2061/URT to KEY; check that PLATE CURRENT meter reads 150 ma of static plate current. (The PLATE lamp on the AM-2061/URT, the HV ON lamp on the PP-2153/U and the XMIT lamp on the CV-730/URC should light.)

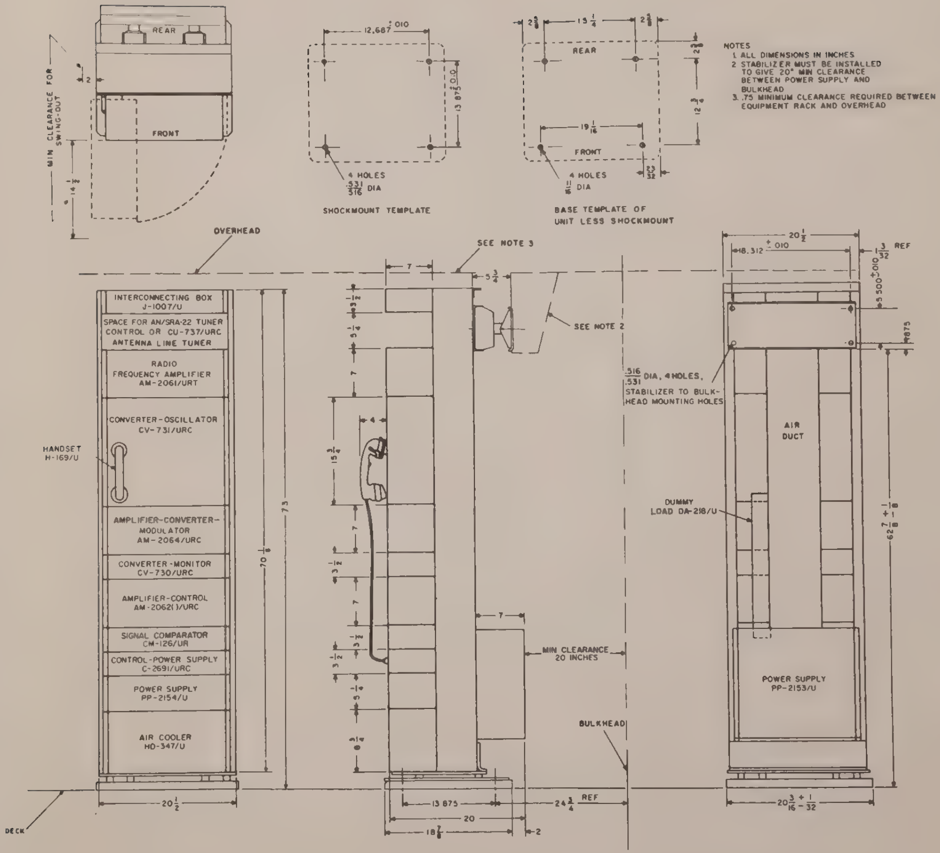
(12) Set PLATE switch to KEY and alternately depress PLATE NO. 1 TEST switch and PLATE NO. 2 TEST switch on the AM-2061/URT; check that the PLATE CURRENT meter reads between 60 and 90 ma of static current for each tube.

(13) Set PLATE switch on AM-2061/URT to ON; PLATE lamp (on AM-2061/URT) and HV ON lamp on Power Supply PP-2153/U should light.

b. ADJUSTMENTS. - Before proceeding with adjustments described below perform the transmitter and receiver tuning procedures and checks in paragraphs 3-2d(1) and 3-2d(2).

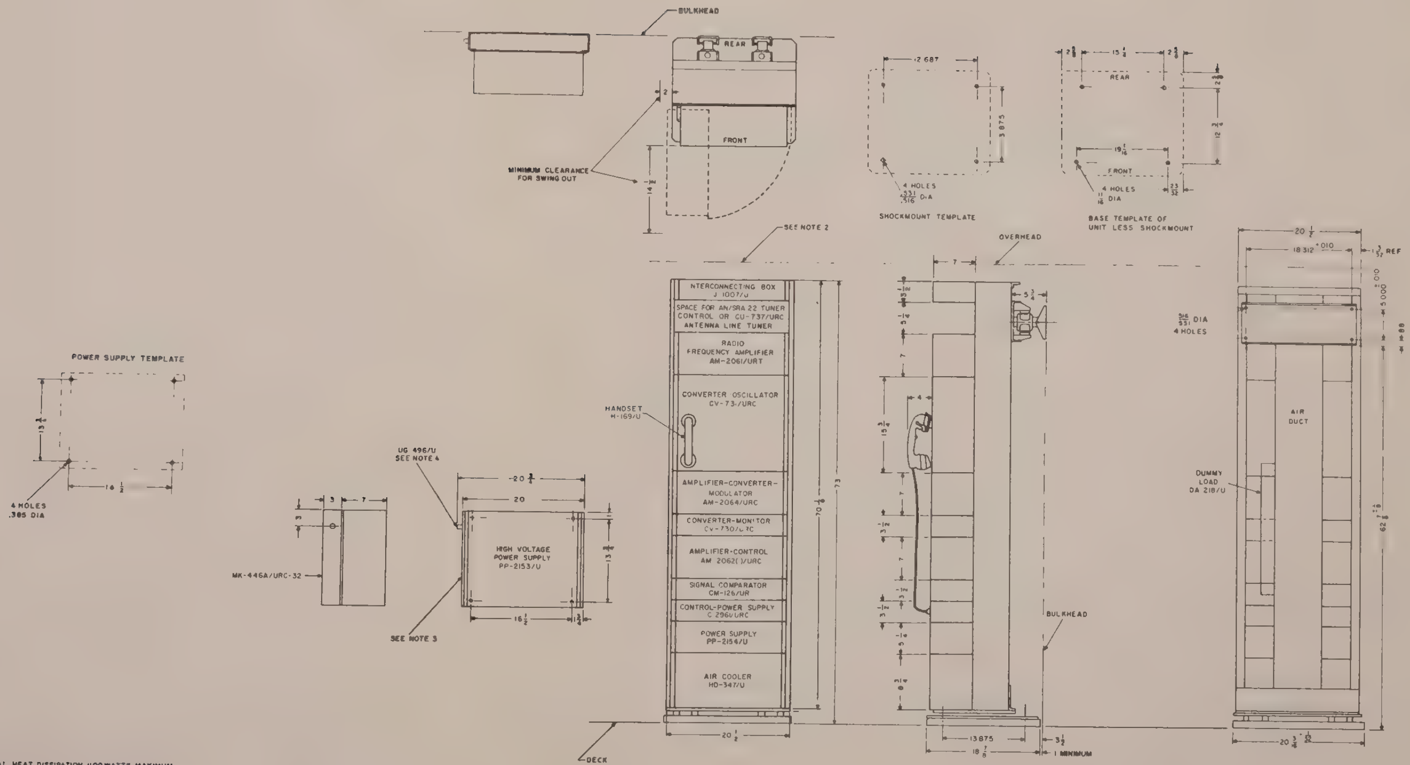
CAUTION

Before operating, set the USB and LSB LINE OUTPUT GAIN controls (under front cover of Amplifier-Control AM-2062A/URC, see figure 5-70) fully counterclockwise. This is done to terminate properly the outputs of i-f/a-f amplifiers of Amplifier-Converter-Modulator AM-2064/URC when the 600-ohm remote lines are not being used.


REAR
FRONT
MIN CLEARANCE FOR SWING-OUT
2
14 1/2
12.687 ± .010
13.875 ± .010
4 HOLES
.531/.516 DIA
SHOCKMOUNT TEMPLATE
2 3/8
15 1/4
2 3/8
REAR
2 3/8
12 3/4
19 1/16
FRONT
23/32
4 HOLES
11/16 DIA
BASE TEMPLATE OF UNIT LESS SHOCKMOUNT
OVERHEAD
SEE NOTE 3
7
5 3/4
SEE NOTE 2
INTERCONNECTING BOX J-1007/U
SPACE FOR AN/SRA-22 TUNER CONTROL OR CU-737/URC ANTENNA LINE TUNER
RADIO FREQUENCY AMPLIFIER AM-2061/URT
CONVERTER-OSCILLATOR CV-731/URC
HANDSET H-169/U
AMPLIFIER-CONVERTER-MODULATOR AM-2064/URC
CONVERTER-MONITOR CV-730/URC
AMPLIFIER-CONTROL AM-2062( )/URC
SIGNAL COMPARATOR CM-126/UR
CONTROL-POWER SUPPLY C-2691/URC
POWER SUPPLY PP-2154/U
AIR COOLER HD-347/U
70 1/8
73
20 1/2
DECK
3 1/2
5 1/4
7
15 3/4
4
7
3 1/2
7
3 1/2
3 1/2
5 1/4
8 3/4
7
MIN CLEARANCE 20 INCHES
BULKHEAD
13.875
24 3/4 REF
20
18 7/8
2
.516/.531 DIA, 4 HOLES, STABILIZER TO BULKHEAD MOUNTING HOLES
20 1/2
18.312 ± .010
1 3/32 REF
5.500 ± .010
.875
AIR DUCT
DUMMY LOAD DA-218/U
POWER SUPPLY PP-2153/U
62 7/8 ± 1/8
20 3/16 ± 1/32

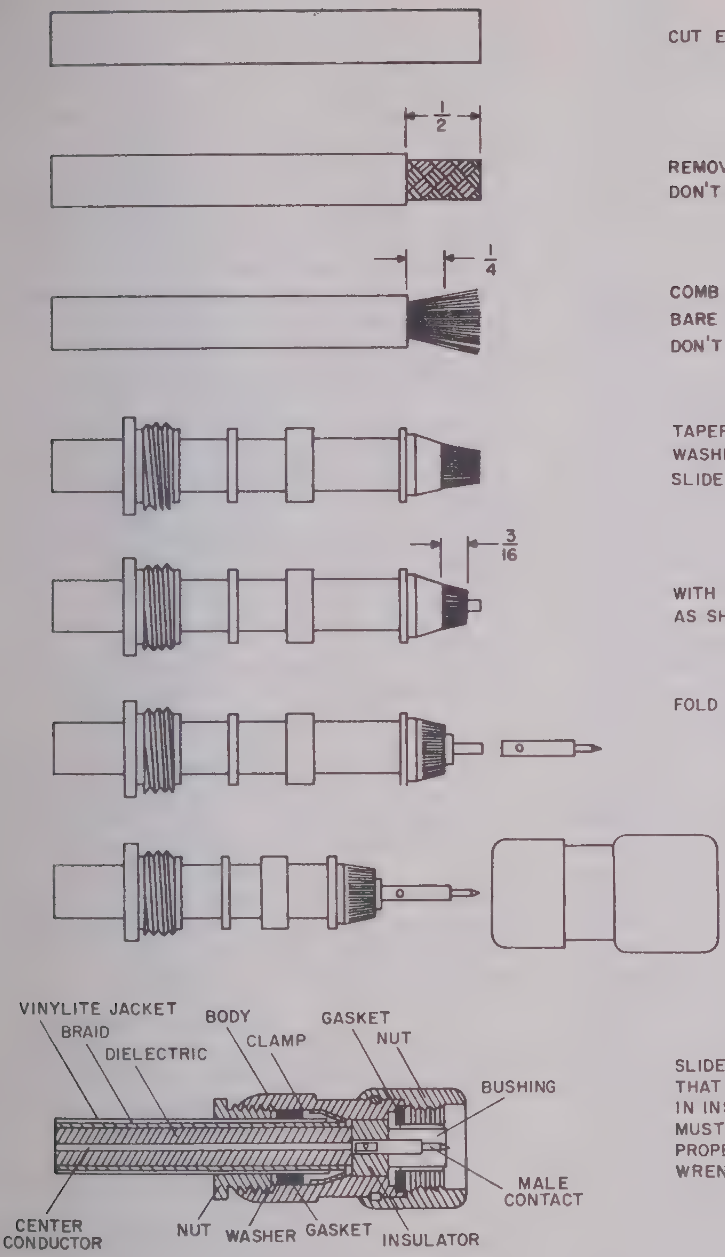
NOTES
1. ALL DIMENSIONS IN INCHES
2. STABILIZER MUST BE INSTALLED TO GIVE 20" MIN CLEARANCE BETWEEN POWER SUPPLY AND BULKHEAD
3. .75 MINIMUM CLEARANCE REQUIRED BETWEEN EQUIPMENT RACK AND OVERHEAD

Figure 2-6. Basic Installation for Radio Set AN/URC-32( )
Showing Outline and Mounting Dimensions


BULKHEAD
REAR
FRONT
2
MINIMUM CLEARANCE FOR SWING OUT
14 1/2
2 687
3 875
4 HOLES .331/.316 DIA
SHOCKMOUNT TEMPLATE
2 3/8
15 1/4
2 3/8
REAR
19 1/16
FRONT
12 3/4
4 HOLES 11/16 DIA
BASE TEMPLATE OF UNIT LESS SHOCKMOUNT
SEE NOTE 2
OVERHEAD
7
5 3/4
20 1/2
18 312 ±.010
1 3/32 REF
5 000 ±.010
NTERCONNECTING BOX J 1007/U
SPACE FOR AN/SRA 22 TUNER CONTROL OR CU-737/URC ANTENNA LINE TUNER
RADIO FREQUENCY AMPLIFIER AM-2061/URT
CONVERTER OSCILLATOR CV-731/URC
HANDSET H-169/U
AMPLIFIER-CONVERTER-MODULATOR AM-2064/URC
CONVERTER-MONITOR CV-730/URC
AMPLIFIER-CONTROL AM 2062( )/URC
SIGNAL COMPARATOR CM-126/UR
CONTROL-POWER SUPPLY C 2960/URC
POWER SUPPLY PP-2154/U
AIR COOLER HD-347/U
70 1/8
73
20 1/2
DECK
15 1/2
4
.316/.331 DIA 4 HOLES
AIR DUCT
DUMMY LOAD DA 218/U
62 7/8
BULKHEAD
13875
18 7/8
3 1/2
1 MINIMUM
20 3/16
POWER SUPPLY TEMPLATE
13 3/4
16 1/2
4 HOLES .385 DIA
UG 496/U SEE NOTE 4
3
7
MK-446A/URC-32
20 3/4
20
HIGH VOLTAGE POWER SUPPLY PP-2153/U
13 3/4
16 1/2
SEE NOTE 3

11 HEAT DISSIPATION 1100 WATTS MAXIMUM
10. POWER REQUIREMENTS 115/230 VOLTS, SINGLE PHASE ,47 TO 63 CPS, 1500 WATTS, P F 90%
9 AMBIENT TEMPERATURE RANGE FOR WHICH EQUIPMENT IS DESIGNED -10° TO +50° CENTIGRADE
8 CRATED VOLUME 35.8 CU FT
7 CRATED DIMENSIONS 79 X 29 X 27
6 CRATED WEIGHT 600 LB (EXPORT PACKING)
5 WEIGHT UNCRATED 390 LB
4 SIX INCH MINIMUM CLEARANCE TO BE MAINTAINED AROUND CONNECTOR FOR ATTACHMENT AND REMOVAL OF MATING CONNECTOR.
3 HIGH VOLTAGE POWER SUPPLY TO BE BOLTED OR TACK WELDED ON BULKHEAD AS DICTATED BY AVAILABLE SPACE
2 .75 MINIMUM CLEARANCE BETWEEN EQUIPMENT RACK AND OVERHEAD.
1. ALL DIMENSIONS ARE IN INCHES
NOTES

Figure 2-7. Flush Mounting Installation for Radio Set AN/URC-32( )
Showing Outline and Mounting Dimensions



CUT END OF CABLE EVEN.

REMOVE VINYL JACKET $\frac{1}{2}$ INCH-DON'T NICK BRAID.

COMB OUT COPPER BRAID AS SHOWN. BARE $\frac{1}{4}$ INCH OF CENTER CONDUCTOR. DON'T NICK CONDUCTOR.

TAPER BRAID AS SHOWN. SLIDE NUT, WASHER AND GASKET ON VINYL JACKET SLIDE CLAMP ON BRAID.

WITH CLAMP IN PLACE, TRIM BRAID AS SHOWN.

FOLD COPPER BRAID BACK ON CLAMP. TIN CENTER CONDUCTOR USING MINIMUM AMOUNT OF HEAT.

HOLDING CONTACT WITH PLIERS, SOFT SOLDER CONTACT TO CENTER CONDUCTOR. IT IS IMPERATIVE THAT BACK END OF CONTACT BE FLUSH WITH POLYETHYLENE DIELECTRIC. DO NOT USE EXCESS SOLDER. WIPE CLEAN-SEE THAT END OF CABLE INSULATOR IS CLEAN AND FREE OF SOLDER, ROSIN AND FOREIGN MATERIAL.

SLIDE BODY INTO PLACE CAREFULLY SO THAT CENTER CONDUCTOR ENTERS HOLE IN INSULATOR. FACE OF CABLE DIELECTRIC MUST FIT FLUSH AGAINST INSULATOR. PROPERLY TIGHTEN BODY AND NUT WITH WRENCHES.

Figure 2-8. Fabrication of RG-8/U Coaxial Cable and Connector

(1) RECEIVER GAIN ADJUSTMENT.

(a) Tune to an SSB signal, and adjust RECEIVER RF GAIN control on the sideband generator (AM-2064/URC) so that the agc does not increase the gain excessively between characters in CW and FSK modes, or between words in single-sideband voice reception.

(b) Adjust SPEAKER GAIN control (under dust cover of AM-2062A/URC, see figure 5-70) for desired local handset or speaker output level.

(2) CARRIER REINSERT ADJUSTMENT.

(a) Set the CW and FSK switch to FSK position, and key to transmit.

(b) Adjust the OUTPUT control for a -6 vu reading on the unit meter (meter switch in the +8 DBM position).

(c) Switch the sideband generator (AM-2064/URC) meter selector switch to RF OUT EXCITER position.

(d) Adjust the EXCITER RF GAIN control for a meter reading of 20 db.

(e) Switch the CW and FSK switch to OFF position.

(f) Switch the TUNE-LOCAL-EXTERNAL control switch to TUNE.

(g) Adjust the CARRIER REINSERT ADJUST control (under the cover of the sideband generator) for a meter reading of 20 db on the sideband generator meter.

(h) Tighten lock nut on the CARRIER REINSERT ADJUST control (do not disturb the previous adjustment).

(3) CW KEYING RELEASE TIME ADJUSTMENT. - The CW and FSK unit (CV-730/URC) is shipped with the CW keying release time set for maximum. This delay time may be reduced by adjusting R18 CW KEYING RELEASE TIME control counterclockwise. This adjustment is located under the dust cover (refer to figure 5-11). The CW keying release time should be set so that the transmitter remains keyed to transmit during normal CW key operation. This can be checked by operating the CW key at the normal rate and checking to see that the XMIT light on the CW and FSK unit remains lighted.

(4) INDEPENDENT-SIDEBAND OPERATION. - Although the AN/URC-32( ) is capable of independent-sideband (A3b) operation, initial installations and operational use, as described in this technical manual, do not use this capability. Because the AN/URC-32( ) are transceivers, the receiving capability of the equipment is not available during periods of transmission. Therefore, if simultaneous reception of the USB and LSB is being conducted and the transmitter is energized to transmit, there will be a loss of the receiving capability. This equipment is used for single sideband (A3a and A3J), single sideband with carrier (A3-compatible), CW (A1), or FSK (F1) modes.

On the A3a and A3J modes above, an audio input and an audio output are applied through Control-Power Supply C-2641/URC to Amplifier-Control AM-2062( )/URC; here the audio input and audio output are switched to the upper-sideband channel or the lower-sideband channel. When simultaneous independent-sideband operation is desired, the transceivers may be operated as receivers or transmitters by connecting the audio inputs and audio outputs directly to the AM-2062( )/URC by using the following 600-ohm balanced line connections in Interconnecting Box J-1007/U (see figure 5-96):

Transmit audio input . . .	LSB:	TBC-1 and TBC-2.
	USB:	TBC-11 and TBC-12.
Receive audio output . . .	LSB:	TBC-13 and TBC-14.
	USB:	TBC-15 and TBC-16.

In the earlier AN/URC-32 models, where independent-sideband operation is contemplated, the 356C-1 line amplifier modules (USB and LSB) should be removed and the AM-3198/URC modules substituted for increased performance. The AM-3198/URC modules may be ordered from stock supply. The AN/URC-32A and AN/URC-32B and any later models will have the AM-3198/URC already provided.

When the SIDEBAND SELECTOR switch on the audio and control unit (AM-2062( )/URC) is in the LOCAL OFF position, the USB and LSB 600-ohm balanced line inputs and the USB and LSB 600-ohm balanced line outputs are connected directly to the USB and LSB audio channels of the AM-2062( )/URC. On transmit, an audio signal applied to the USB input will appear as a USB signal in the r-f output, and an audio signal applied to the LSB input will appear as an LSB signal in the r-f output. On receive, a USB r-f signal will appear at the USB audio output, and an LSB r-f signal will appear at the LSB audio output. By applying audio signals to both the USB and LSB 600-ohm line inputs, the AN/URC-32( ) equipments will transmit USB and LSB r-f signals simultaneously. Likewise, the transceiver will receive an r-f signal composed of both a USB and an LSB signal, presenting the LSB signal at the LSB audio output and the USB signal at the USB audio output.

(a) RECEIVE LINE OUTPUT GAIN ADJUSTMENTS. - The following procedure is used to adjust the output level of the receive audio signal to match the remote 600-ohm balanced audio lines. The USB and LSB LINE OUTPUT GAIN controls are screwdriver adjustments located under the dust cover of Amplifier-Control AM-2062( )/URC (see figure 5-70).

1. Tune to an LSB signal, and adjust RECEIVER RF GAIN control fully clockwise. Adjust SPEAKER GAIN control on speaker amplifier in the AM-2062( )/URC (see figure 5-70) for desired audio output in the headphone of Dynamic Handset H-169/U.

2. Set SIDEBAND SELECTOR to LOCAL OFF, and adjust LSB LINE OUTPUT GAIN control for desired remote line level with MONITOR switch in the LSB REC position; the VU METER on Converter-Monitor CV-730/URC meters the LSB line level.

3. Repeat step 2. using the USB LINE OUTPUT GAIN control.

(b) LINE INPUT GAIN ADJUSTMENTS FOR USB OR LSB TRANSMIT OPERATION. - The following procedure is used to adjust the audio input level of the transmit audio signal from the remote 600-ohm balanced audio lines when the AN/URC-32( ) is to be used on USB or LSB transmit but not on both simultaneously. The USB and LSB LINE INPUT GAIN controls are screwdriver adjustments located under the dust cover of the AM-2062( )/URC (see figure 5-70).

1. Set USB and LSB LINE INPUT GAIN controls fully counterclockwise.

2. Tune and load the AN/URC-32( ) using the procedures of paragraphs 3-2a. and 3-2b. Set SIDEBAND SELECTOR switch on AM-

2062( )/URC to USB, and set meter switch arc AM-2064/URC to AGC-TGC.

3. With a normal audio signal present on the remote LSB audio input line, key to transmit, and turn LSB LINE INPUT GAIN control clockwise until meter reading (tgc) on AM-2064/URC peaks in red portion of scale. Key to transmit by setting XMIT-REC-XMIT TEST switch on the CV-730/URC to XMIT.

4. Set SIDEBAND SELECTOR switch to LSB. With a normal audio signal present on remote USB signal input line, key to transmit, and turn USB LINE INPUT GAIN control clockwise until meter again (tgc) peaks in red portion of scale.

(c) LINE INPUT GAIN ADJUSTMENTS FOR SIMULTANEOUS USB AND LSB TRANSMIT OPERATION. - The following procedure is used to adjust the audio input level of the transmit audio signal from the remote 600-ohm balanced audio lines when the AN/URC-32( ) is to be used on simultaneous USB and LSB transmit. The USB and LSB LINE INPUT GAIN controls are screwdriver adjustments located under the dust cover of Amplifier-Control AM-2062( )/URC.

1. Set USB and LSB LINE INPUT GAIN controls fully counterclockwise. Tune and load the AN/URC-32( ) using the procedures of paragraphs 3-2a. and 3-2b.

Note

The input level to one of the input lines may be at a higher or a lower level than the input level to the other line. The VU METER on the CV-730/URC must not indicate over 0 vu for the sideband with the highest input level.

2. Unkey the transmitter, and adjust USB and LSB LINE INPUT GAIN controls so the VU METER indicates no more than 0 vu for each sideband.

3. Set the TUNE-LOCAL-EXTERNAL CONTROL switch to TUNE.

4. Key transmitter, and adjust EXCITER RF GAIN control for 60 watts forward power as indicated on antenna tuner (AN/SRA-22 or CU-737/URC) wattmeter.

5. Set TUNE-LOCAL-EXTERNAL CONTROL switch to LOCAL.

6. With signal applied in both sidebands, the AGC-TGC panel meter on Amplifier-Converter-Modulator AM-2064/URC should indicate within the red area of the scale for full rated output. If indication is greater than the red area of scale, adjust the EXCITER RF GAIN control for indication in red area.

2-7. INTERFERENCE REDUCTION.

Under normal conditions of installation and operation, Radio Set AN/URC-32A( ) will not interact with other equipment. For best performance, interconnections to auxiliary equipment should be made with the shortest practicable cable lengths.

SECTION 3

OPERATION

The functional operation and a description of all controls and operating procedures are given in Volume 2, Operator's Manual for Radio Set AN/URC-32( ).

SECTION 4

TROUBLE SHOOTING

4-1. LOGICAL TROUBLE SHOOTING.

Logical trouble shooting is based primarily on knowledge of how the equipment ought to operate under given conditions. Such knowledge, in turn, is based on sound understanding of the equipment, its function and limitations. The approach used in this manual is based on six steps: symptom recognition, symptom elaboration, listing probable faulty functions, localizing the faulty function, localizing trouble to the circuit, and failure analysis. These steps aid in recognizing and defining the trouble, localizing the faulty functions and circuits, and analyzing the failure.

a. SYMPTOM RECOGNITION. - The first step in any trouble-shooting procedure is to recognize that a trouble exists. Such recognition requires a complete knowledge of operating characteristics because many troubles are not due to component failure. A trouble of this type normally is discovered during preventive maintenance checks. It is important that troubles of this nature be recognized.

b. SYMPTOM ELABORATION. - After recognition of an original trouble, all aids inherent in the equipment are used to expand on the original trouble. The front panel controls and metering devices are used to better identify the problem and indicate possible areas of analysis. It is important to realize that checking or manipulating the operating controls may eliminate the problems.

c. LISTING PROBABLE FAULTY FUNCTIONS. - After a trouble has been defined, the next step is determination of the most probable functional areas at fault in the equipment. The basis for such a set of logical choices is knowledge of the information contained in this manual. The over-all functional description and associated block diagram should be referred to when selecting functional areas for examination.

d. LOCALIZING THE FAULTY FUNCTION. - Unfortunately, it is not uncommon in trouble shooting to find cases where 60 percent of the total repair time is spent in determining what to repair. To reduce this diagnostic time and increase efficiency in localizing trouble, the functional sections selected in paragraph 4-1c. should be tested in the order requiring the least amount of time. This process requires selecting the function to be tested first. Such a selection is based on the validity of the logical choices previously made and the difficulties in making the associated tests. If the tests performed on the first function chosen do not prove this area to be at fault, proceed to the next function. This process is continued until the fault is located. As aids in this process, the manual contains a functional description and servicing block diagram for each functional section. Data are included at key check points on the block diagram to aid in isolating the fault. In addition, test data are provided to supplement the functional description and block diagram for each section.

e. LOCALIZING TROUBLE TO THE CIRCUIT. - After the faulty functional section has been isolated, additional logical choices must be made to determine the circuit, or circuits, at fault. Servicing block diagrams for each functional section and functional circuit groups indicate signal flow and provide test location data to bracket and isolate the faulty circuit. Descriptions, simplified schematics, and pertinent test data are placed in one area of the manual. Where practicable, information is contained on facing pages. Information too lengthy to be presented in this manner is referenced from the test data portion of trouble shooting.

f. FAILURE ANALYSIS. - When the trouble has been located to the faulty circuit or component, the procedures followed to this point should be reviewed before corrective action is taken. This should be done to determine why the fault affected the equipment. Generally, such a review is necessary to assure that the fault is the cause of malfunction and not just the result of malfunction.

4-2. OVER-ALL FUNCTIONAL DESCRIPTION.

Radio Set AN/URC-32M( ) is a transceiver utilizing simplex operation with common tuned circuits on a common injection for receive and transmit. This means the transmit frequency is always exactly the same as the receive frequency. The transceiver is a double-conversion superhetrodyne device with a fixed intermediate frequency of 300 kc and a variable i-f range of 1.7 to 3.7 mc. The transmit and receive radio-frequencies range from 2 to 30 mc. The 2- to 30.0-mc r-f range is divided into four bands: band 1, 2- to 3.7 mc; band 2, 3.7 to 7.7 mc; band 3, 7.7 to 15.7 mc; and band 4, 15.7 to 30 mc. The transceiver uses single conversion on band 1, as the band 1 r-f falls within the variable 1.7 to 3.7 mc i-f range. After the band is selected, the desired operating frequency can be set in 1-kc increments on a direct-reading frequency counter (Radio Set AN/URC-32B has a 0.1-kc frequency increment capability).

The transceiver is primarily designed for single-sideband transmission and reception on upper sideband (USB), lower sideband (LSB), or two independent sidebands with separate audio and i-f channels for each sideband. In addition to single-sideband operation, provisions are included for AM (USB with carrier reinserted), CW, and FSK operation. Transmit operation provides a peak-envelope-power (PEP) output of 500 watts.

An over-all functional block diagram of the transceiver is shown in figure 4-1. The various signal inputs and signal outputs are separated into trans-

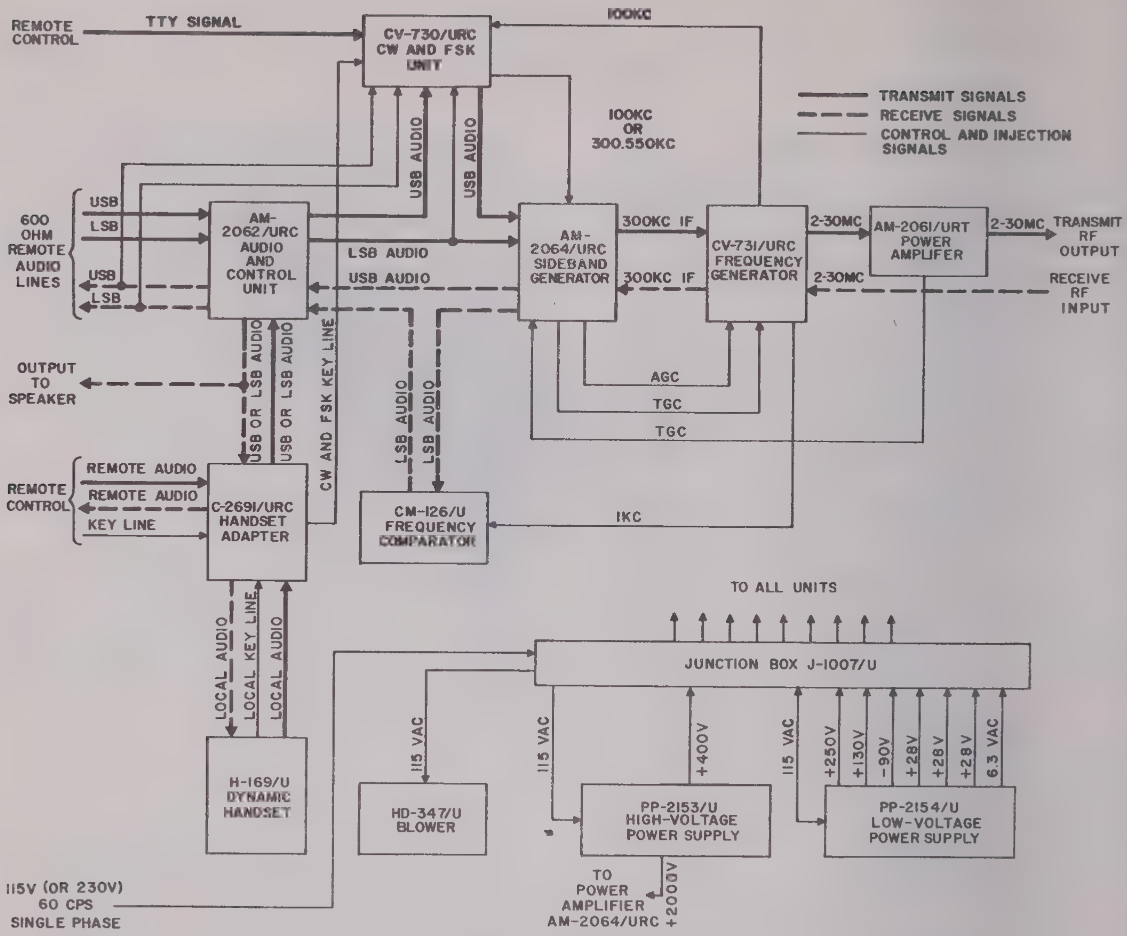

REMOTE CONTROL
TTY SIGNAL
CV-730/URC CW AND FSK UNIT
100KC
TRANSMIT SIGNALS
RECEIVE SIGNALS
CONTROL AND INJECTION SIGNALS
USB AUDIO
USB AUDIO
100KC OR 300.550KC
600 OHM REMOTE AUDIO LINES
USB
LSB
USB
LSB
AM-2062/URC AUDIO AND CONTROL UNIT
LSB AUDIO
USB AUDIO
AM-2064/URC SIDEBAND GENERATOR
300KC IF
300KC IF
CV-731/URC FREQUENCY GENERATOR
2-30MC
2-30MC
AM-2061/URT POWER AMPLIFER
2-30MC
TRANSMIT RF OUTPUT
RECEIVE RF INPUT
OUTPUT TO SPEAKER
USB OR LSB AUDIO
USB OR LSB AUDIO
CW AND FSK KEY LINE
LSB AUDIO
LSB AUDIO
AGC
TGC
TGC
REMOTE CONTROL
REMOTE AUDIO
REMOTE AUDIO
KEY LINE
C-2691/URC HANDSET ADAPTER
CM-126/U FREQUENCY COMPARATOR
1KC
TO ALL UNITS
LOCAL AUDIO
LOCAL KEY LINE
LOCAL AUDIO
JUNCTION BOX J-1007/U
115 VAC
115 VAC
+400V
115 VAC
+250V
+130V
-90V
+28V
+28V
+28V
6.3 VAC
H-169/U DYNAMIC HANDSET
HD-347/U BLOWER
PP-2153/U HIGH-VOLTAGE POWER SUPPLY
PP-2154/U LOW-VOLTAGE POWER SUPPLY
115V (OR 230V) 60 CPS SINGLE PHASE
TO POWER AMPLIFIER AM-2064/URC
+2000V

Figure 4-1. Radio Set AN/URC-32( ), Over-all Functional Block Diagram

mitting, receiving, and control signals. The transmit signal flow is indicated by heavy lines, the receive signal flow is indicated by dashed lines, and the control signals by light lines. The high-voltage and low-voltage power supply units are also shown in the block diagram. The three main function circuits, transmit, receive, and control circuits, which contain more than one unit are discussed using a functional block diagram for each circuit. Due to the characteristics of the control circuit, the control circuit functional diagram requires detailed illustration coverage. The high-voltage and low-voltage power supply units are discussed using the over-all functional block diagram of the transceiver (figure 4-1).

a. TRANSMIT SIGNALS. - Figure 4-2 is a functional block diagram of the transmit circuit. On voice operation, the audio signals, received from the 600-ohm remote audio lines or Control-Power Supply C-2691/URC, (handset adapter), are amplified in Amplifier-Control AM-2062( )/URC (audio and control unit) and applied to the Amplifier-Converter-Modulator AM-2064/URC (sideband generator). The LSB audio signals are applied directly to the sideband generator, and the USB audio signals are applied through the Converter-Monitor CV-730/URC (CW and FSK unit) to the sideband generator.

On CW or FSK operation, the CW and FSK unit supplies audio tones to the sideband generator. On FSK operation, the CW and FSK unit supplies audio tones of 1575 cps for space and 2425 cps for mark. On CW operation, the CW and FSK unit supplies audio tones of 1000 cps for space and 1500 cps for mark. The sideband generator translates the audio signal to the selected sideband at an i-f of 300 kc. The sideband generator uses the 100-kc signal from the CW and FSK unit to generate the 300 kc i-f. The 300-kc i-f single-sideband output signal from the sideband generator is applied to Converter-Oscillator CV-731/URC (frequency generator) which translates the i-f signal to an r-f signal in the range of 2.0 to 30.0 mc, as selected on the front panel of the frequency generator. The r-f single-sideband signal is applied from the frequency generator to Radio Frequency Amplifier AM-2061/URT (power amplifier). The

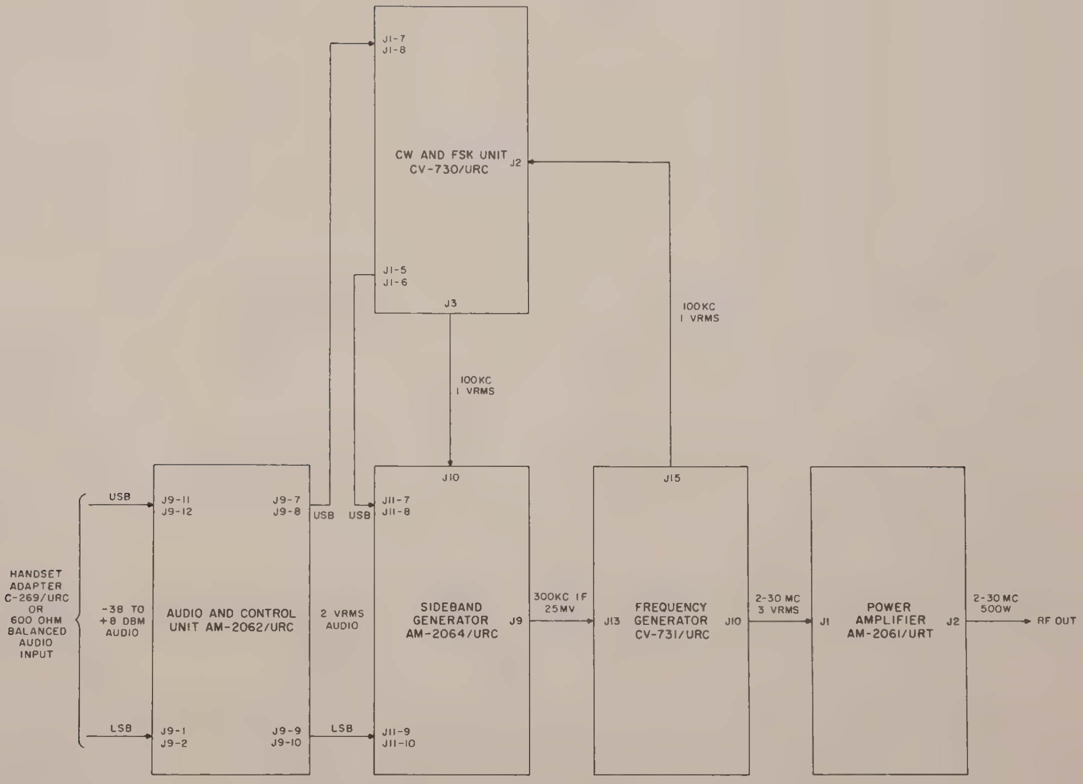

CW AND FSK UNIT CV-730/URC
J1-7
J1-8
J2
J1-5
J1-6
J3
100KC 1 VRMS
100KC 1 VRMS
HANDSET ADAPTER C-269/URC OR 600 OHM BALANCED AUDIO INPUT
USB
LSB
-38 TO +8 DBM AUDIO
AUDIO AND CONTROL UNIT AM-2062/URC
J9-11
J9-12
J9-7
J9-8
J9-1
J9-2
J9-9
J9-10
USB
USB
2 VRMS AUDIO
LSB
SIDEBAND GENERATOR AM-2064/URC
J10
J11-7
J11-8
J11-9
J11-10
J9
300KC IF 25MV
FREQUENCY GENERATOR CV-731/URC
J15
J13
J10
2-30 MC 3 VRMS
POWER AMPLIFIER AM-2061/URT
J1
J2
2-30 MC 500W
RF OUT

Figure 4-2. Radio Set AN/URC-32( ), Transmit Circuit, Functional Block Diagram

output from the power amplifier is the 500-watt PEP transmit r-f output.

b. RECEIVE SIGNALS. - Figure 4-3 is a functional, block diagram of the receive circuit. The receive r-f input signals received at the input of frequency generator are heterodyned down to a 300-kc i-f signal by the frequency generator. The 300-kc i-f signal is applied to the sideband generator. A 1-kc signal output from the frequency generator is applied to Signal Comparator CM-126/UR (frequency comparator) for frequency monitoring purposes. A 100-kc signal output from the frequency generator is applied to the CW and FSK unit to be sent on from the CW and FSK unit to the sideband generator. On FSK operation, the CW and FSK unit applies a 300.550-kc signal to the sideband generator instead of the 100-kc signal. The 300.550-kc signal is used to obtain the audio tone outputs of 2125 cps on space and 2975 cps on marks from the sideband generator. This conversion is necessary for operation with standard Navy teletypewriter converters having a center pass-band frequency of 2550 cps. The sideband generator hetrodynes the i-f signals down to audio signals. The selected audio output signals from the sideband generator are applied to the audio and control unit. The USB audio signals are applied directly to the audio and control unit, and the LSB audio signals are applied through the frequency comparator. The audio and control unit amplifies the audio signals and sends the signals out to the handset adapter or to the 600-ohm balanced remote audio lines.

c. CONTROL CIRCUITS. - Refer to figure 4-4. The transceiver is keyed to transmit by applying a ground to the transmit key line. The means by which this ground is supplied to the transmit key line depends upon the mode of operation and the position of the HANDSET and OSC CONTROL switches. On voice operation, the OSC CONTROL switch is set to OFF. This de-energizes the CW and FSK unit circuits and connects the transmit key line to the HANDSET switch. When the HANDSET switch is in LOCAL, a ground is applied to the transmit key line by relay K1 in the handset adapter. This relay is energized by the push-to-talk switch on the local dynamic handset. When the HANDSET switch is in REMOTE, the transmit key line is connected to the remote key line, and a ground is applied by a push-to-talk relay in the remote phone unit. On FSK teletypewriter operation, the OSC CONTROL switch is set to FSK and the HANDSET switch is set to REMOTE. This energizes the FSK circuits of the CW and FSK unit and connects the transmit key line to the remote key line. A ground then is applied to the remote key line at the TTY control panel. On CW operation, the OSC CONTROL switch is set to CW 1KC or CW 1.5KC and the HANDSET switch is set to REMOTE. This energizes the CW circuits of the CW and FSK unit and connects the remote key line to the CW key line of the CW and FSK unit. The remote key line then becomes a CW key input and is grounded by the CW key. In addition to supplying grid blocking to buffer V1B, the CW key energized the CW transmit keying and delayed release circuit which applies a ground to the transmit key line. This ground is applied by relay K1 of the CW and FSK unit. The ground energizes the receive-transmit relays of the transceiver. Relay K1 in the sideband generator applies the transmit audio signals to the balanced modulator, and closes the contacts which are used to operate the antenna tuner bypass circuit in a remote antenna tuner when crossband operation is used. With the antenna tuner bypass switch in the remote position, the antenna tuner is

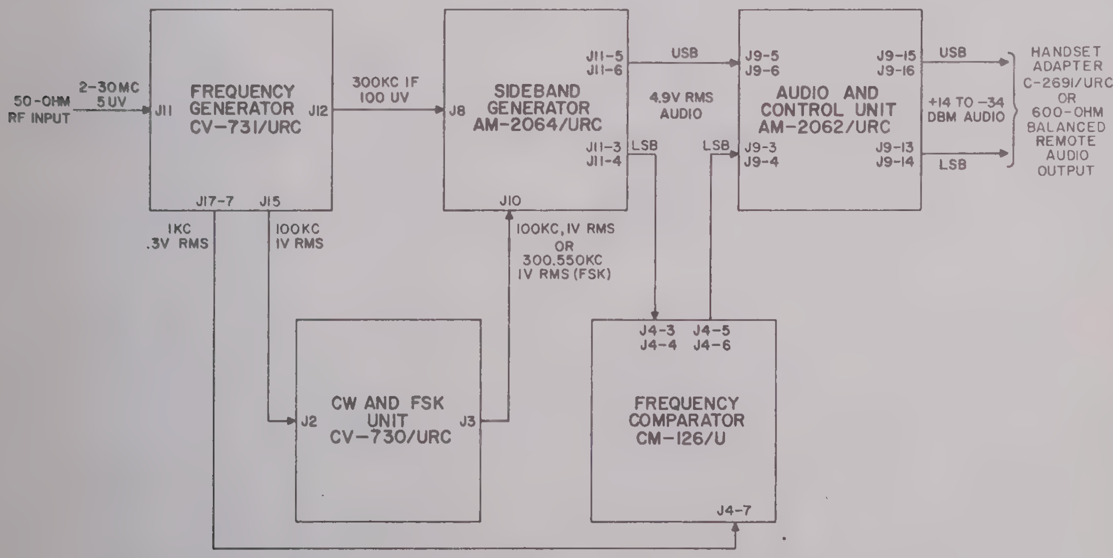

50-OHM RF INPUT
2-30MC 5UV
J11
FREQUENCY GENERATOR CV-731/URC
J12
J17-7
J15
300KC IF 100 UV
J8
SIDEBAND GENERATOR AM-2064/URC
J11-5
J11-6
J11-3
J11-4
J10
USB
4.9V RMS AUDIO
LSB
LSB
J9-5
J9-6
J9-3
J9-4
AUDIO AND CONTROL UNIT AM-2062/URC
J9-15
J9-16
J9-13
J9-14
USB
+14 TO -34 DBM AUDIO
LSB
HANDSET ADAPTER C-2691/URC OR 600-OHM BALANCED REMOTE AUDIO OUTPUT
1KC .3V RMS
100KC 1V RMS
100KC, 1V RMS OR 300.550KC 1V RMS (FSK)
J2
CW AND FSK UNIT CV-730/URC
J3
J4-3
J4-4
J4-5
J4-6
FREQUENCY COMPARATOR CM-126/U
J4-7

Figure 4-3. Radio Set AN/URC-32( ), Receive Circuit, Functional Block Diagram

bypassed when the relay contacts are open. When crossband operation is not being used, the bypass switch in the antenna tuner should be in the tuner-in position to decrease the transmit keying time. This increased transmit keying time is due to the transmit keying circuit being interlocked through the antenna tuner bypass circuit so that the transceiver is not keyed to transmit until the tuner bypass circuit of the remote antenna tuner switches from bypass to tuner-in. With the CW keying used in the transceiver, this time lag may result in partial loss of the first character. Relay K2 in the frequency generator disables the receiver circuit of the r-f tuner module, applying a bias voltage to the grids of the receiver stages, and disconnecting the receive r-f input to the r-f tuner module. Relay K2 in the power amplifier grid-block keys the driver and power amplifier stages. This relay is interlocked through contacts of relay K3 which prevents the operation of K2 when the power amplifier plate voltage is not applied. The output level of the power amplifier is controlled by controlling the drive plate and screen voltage and the power amplifier screen voltage. This is accomplished by inserting a dropping resistor, R16, in the 400-volt supply line for low-level tune operation. For high-power operation, this resistor is shorted out through OPERATE-TUNE switch S1B and the antenna tuner high-power interlock. The antenna tuner high-power interlock prevents high-power operation while the antenna tuner is being tuned to the operating frequency. Antenna switching from the receiver input of the frequency generator to the transmitter output of the power amplifier is accomplished at the antenna coupler (accessory equipment).

d. POWER SUPPLY. - Refer to figure 4-1. Input 115-volt a-c (or 230 volt a-c) power is applied through Interconnecting Box J-1007/U (junction box) to Power Supply PP-2153/U (high-voltage power supply), Power Supply PP-2154/U (low-voltage power supply), and Electronic Equipment Air Cooler HD-347/U (blower). The low-voltage power supply furnishes filament, bias, +28-volt d-c relay power, and low-voltage plate power for the transceiver. The high-voltage power supply furnishes screen and plate voltages for the power amplifier. All supply voltages, except the high-voltage supply to the power amplifier, are applied to the transceiver units through the junction box.

4-3. FUNCTIONAL SECTION DESCRIPTIONS.

A functional description of each of the major units which make up the Radio Set AN/URC-32( ) series is given in this paragraph. Each unit is broken down according to its subassemblies. In turn each subassembly is broken down to the major functional groups of which it is composed. In most instances, the unit servicing block diagram is used in the functional description of the unit. The lowest level in this breakdown process is the simplest functional block: for example, a multivibrator circuit block.

Only those circuits which are uncommon (those circuits not covered in the Handbook of Electronic Circuits, NAVSHIPS 900,000.102) are discussed. In all other cases reference is made to the schematic diagrams in section 5. Reference is made to simplified schematic diagrams, functional block diagrams, servicing block diagrams, or schematic diagrams whichever will best aid in the presentation of the unit discussions.

a. INTERCONNECTING BOX J-1007/U. - Interconnecting Box J-1007/U (junction box) is used to make interunit and external connections and uses 16 or 18 of the 20-pin terminal blocks to make the connections. The junction box contains the thermal relay receiver input protector unit and fuses for the primary power to the system. The thermal relay receiver input protector unit prevents excessive current (100 ma or greater) from entering the receiver antenna input.

(1) FUNCTIONAL TEST DATA. - The following information provides over-all functional test data and equipment required for the junction box.

(a) DETERMINING OVER-ALL PERFORMANCE. - The over-all performance tests in the junction box consist of observing the fuse indicators for a blown fuse and the antenna overload indicator lamp for overload conditions. If replacing a blown fuse and operation of the reset switch does not restore the junction box to a normal operating condition, trouble shooting is necessary. Trouble shooting of the junction box can be accomplished with Multimeter AN/PSM-4C using the junction box interconnecting wiring diagram in figure 5-96 and the thermal relay input protector simplified schematic diagram figure 4-5 as a guide.

(b) EQUIPMENT AND TOOLS REQUIRED FOR FUNCTIONAL TESTING. - The test equipment required for functional testing of the junction box consists of Multimeter AN/PSM-4C.

(c) ADJUSTMENTS AND ALIGNMENTS. - No adjustments or alignments are required.

(2) DETAILED CIRCUIT DESCRIPTION. - The detailed description of this unit consists of a discussion of the thermal relay receiver input protector unit. The interunit connections are shown in Interconnecting Box J-1007/U wiring diagram in figure 5-96 and are self-explanatory.

Refer to thermal relay receiver input protector unit simplified schematic diagram figure 4-5. The antenna normally is disconnected from the receiver input when the 28-volt supply is off. When 28 volts is applied, coaxial relay K1 is energized through thermal relay K2 normally closed contacts. When the coaxial relay is energized, the antenna is connected to the receiver input through the series combination of contacts and the thermal relay heater element. Neon lamp DS2, R1, and C2 form a transient suppressing network to prevent relay K1 coil discharge from arcing across the contacts of relay K2. However, should a high r-f voltage be induced in the antenna, the excessive current developed will warm the thermal relay heater element sufficiently to cause its contacts to open. This will remove the 28 volts from the coaxial relay causing it to become de-energized.

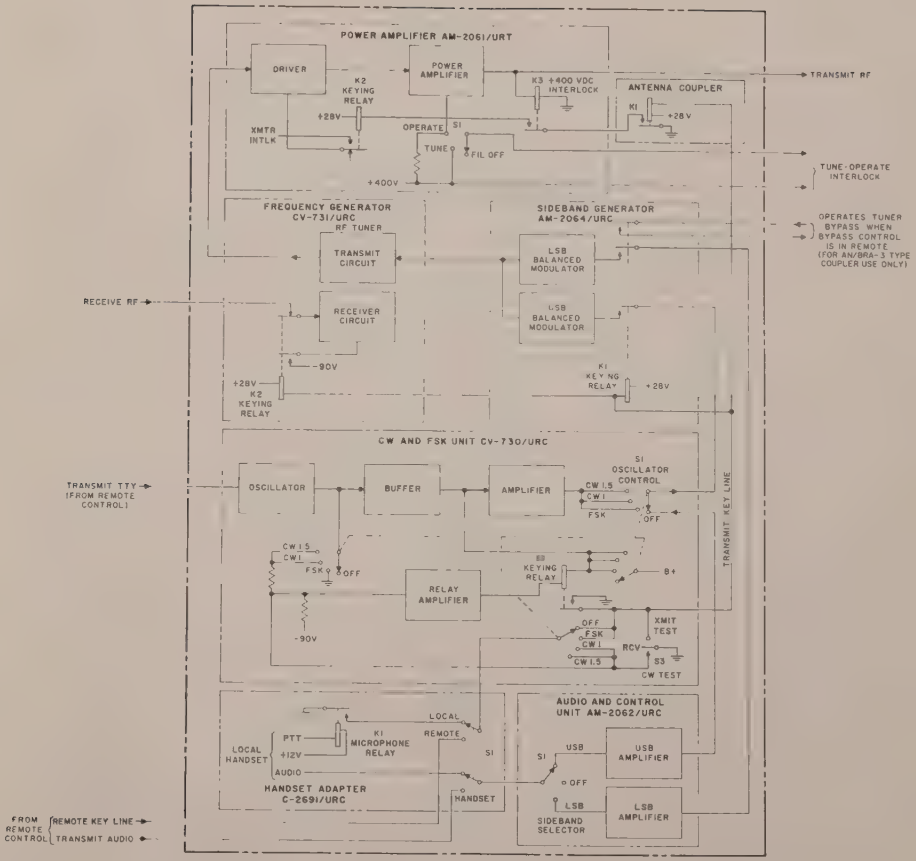

POWER AMPLIFIER AM-2061/URT
DRIVER
POWER AMPLIFIER
K2 KEYING RELAY
+28V
XMTR INTLK
OPERATE
S1
TUNE
FIL OFF
+400V
K3 +400 VDC INTERLOCK
ANTENNA COUPLER
K1
+28 V
TRANSMIT RF
TUNE-OPERATE INTERLOCK
FREQUENCY GENERATOR CV-731/URC
RF TUNER
TRANSMIT CIRCUIT
RECEIVER CIRCUIT
RECEIVE RF
-90V
+28V
K2 KEYING RELAY
SIDEBAND GENERATOR AM-2064/URC
LSB BALANCED MODULATOR
USB BALANCED MODULATOR
OPERATES TUNER BYPASS WHEN BYPASS CONTROL IS IN REMOTE (FOR AN/BRA-3 TYPE COUPLER USE ONLY)
K1 KEYING RELAY
+28V
CW AND FSK UNIT CV-730/URC
OSCILLATOR
BUFFER
AMPLIFIER
S1 OSCILLATOR CONTROL
CW 1.5
CW 1
FSK
OFF
TRANSMIT TTY (FROM REMOTE CONTROL)
CW 1.5
CW 1
FSK
OFF
RELAY AMPLIFIER
-90V
K3 KEYING RELAY
B+
OFF
FSK
CW 1
CW 1.5
XMIT TEST
RCV
S3
CW TEST
TRANSMIT KEY LINE
HANDSET ADAPTER C-2691/URC
LOCAL HANDSET
PTT
+12V
AUDIO
K1 MICROPHONE RELAY
LOCAL
REMOTE
S1
HANDSET
AUDIO AND CONTROL UNIT AM-2062/URC
S1
USB
OFF
LSB
SIDEBAND SELECTOR
USB AMPLIFIER
LSB AMPLIFIER
FROM REMOTE CONTROL
REMOTE KEY LINE
TRANSMIT AUDIO

Figure 4-4. Radio Set AN/URC-32( ), Control Circuits, Functional Block Diagram

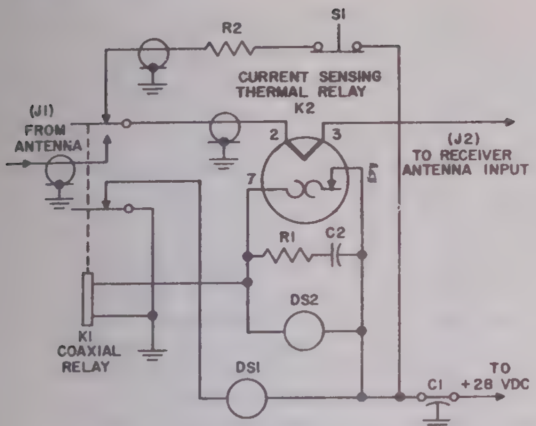


Figure 4-5. Thermal Relay Input Protector, Simplified Schematic Diagram

A new path will supply d-c current to the thermal relay in order that its contacts will stay open and keep the coaxial relay de-energized. This series path is from 28 volts through normally closed reset switch S1, resistor R2, the relay contacts, and the thermal relay heater to the receiver input, and within the receiver to a band coil and to ground.

The red indicator lamp, DS1, will light to indicate that excessive current has been detected and to indicate that the antenna has been disconnected from the receiver.

b. RADIO FREQUENCY AMPLIFIER AM-2061/URT. - Radio Frequency Amplifier AM-2061/URT (power amplifier) is an r-f power amplifier which amplifies the 0.2-watt r-f output from a frequency generator to a 500-watt peak-envelope-power r-f power output. The r-f power output is tunable over a frequency range of 2 to 30 mc. Frequency-calibrated front panel controls allow presetting of the power amplifier through the 2- to 30-mc frequency range. The unit consists of a driver stage, a power amplifier stage, and the necessary bias and control circuits.

(1) FUNCTIONAL TEST DATA. - The following information provides over-all functional test data and equipment required for the power amplifier unit.

(a) DETERMINING OVER-ALL PERFORMANCE. - The following operational checks are to be performed on the power amplifier:

1. TIME-DELAY CIRCUITS. - Turn power switch S1 to the TUNE position and plate power switch S9 to the ON position. Within 17 to 23 seconds after these switches are turned on, time-delay relay K1 should close to complete the circuit to the plate power relay in the high-voltage power supply. When the plate power relay is closed, power should be applied to the transformer in the power supply. This is indicated by the red pilot light. Repeat the above procedure with primary power switch S1 turned to the OPERATE position.

2. PLATE 1 AND PLATE 2 BALANCE. - After replacement of tubes, check the balance of plate 1 and plate 2 by alternately throwing S2 and S3 to TEST and checking the PLATE CURRENT indication for a balance. The total current with drive should not exceed 600 ma.

3. POWER AMPLIFIER FILAMENT VOLTAGE. - Tube life is materially shortened if correct filament voltage is not obtained. With the power amplifier operating under normal conditions, measure V3 and V4 filament voltage (at J4 and J5, labeled 6.0V AC on the front panel). If readings of 5.7 to 6.3 volts a-c are not obtained constantly, it is recommended that the primary tap position on filament transformer T1 be positioned to compensate for high or low voltage. Refer to figure 5-99. Isolation of a trouble in the power amplifier is primarily by substitution of electron tubes, checking filaments, and visual checks.

(b) EQUIPMENT AND TOOLS REQUIRED FOR FUNCTIONAL TESTING. - The test equipment required for testing on the over-all functional level consists of Electronic Multimeter AN/USM-116.

(c) ADJUSTMENTS AND ALIGNMENTS. - The adjustments to be performed on the power amplifier are the bias voltage adjustment (paragraph 5-2b(1)(a)), neutralizing adjustment (paragraph 5-2b(1)(b)), the automatic load control (alc) adjustment (paragraph 5-2b(1)(d)), and the screen-voltage adjustment (paragraph 5-2b(1)(d)).

(2) DETAILED CIRCUIT DESCRIPTION. - Refer to servicing block diagram 4-6 and to schematic diagram 5-99.

(a) DRIVER STAGE. - The input signal to the driver stage is connected from coaxial receptable J1 through coupling capacitor C1 to the control grids of driver tubes V1 and V2. Resistor R1 provides low-impedance termination for the input signal. Plate output of V1 and V2 is tuned by variable inductor L4 and fixed capacitors C16, C17, C18, C19, and the input capacitance of the power amplifier stage. Resistors R26, R27, and R28 reduce circuit Q to keep grid drive voltage approximately equal on all four bands. The fixed capacitors are switched into the circuit by band-switch section S4. Negative feedback from the power amplifier plate circuit to the driver cathodes improves linearity. This negative feedback is coupled to the driver cathodes through capacitor C11 from a capacitive tap in the neutralizing feedback loop. Figure 4-7 is a graphical representation of the approximate settings of the DRIVER TUNE control for the various power amplifier operating frequencies (2 to 30 mc).

(b) POWER AMPLIFIER STAGE. - Signal from the driver plate tuning circuit is direct coupled to the grids of power amplifiers V3 and V4. The power amplifier tubes are tetrodes connected in parallel. The plate output is tuned by a pi network consisting of variable inductor L10 and fixed capacitors C33 and C21 through C28. Fixed capacitors C33, C22, and C23 are all used for band 1; C24 for band 2; C22 and C33 for band 3; and C33 for band 4. Loading and output impedance match is accomplished for each of the four bands by switching taps on inductor L11 and fixed capacitors C30, C31, and C32. Capacitor C29 is part of the loading network on all bands. Output power is connected to receptacle J2 for delivery to the antenna network or to the antenna. The pi network matches 50-ohm impedance on all four bands. A grid-to-plate neutralizing circuit is included in the power amplifier to balance out the feedback due to residual grid-to-plate interelectrode capacitance. Simplified diagrams of the neutralizing circuit are shown in figure 4-8. Feedback voltage is applied from the plate circuit to the input circuit through the capacitor network consisting of C8, C10, and variable neutralizing capacitor C12. Values of these three capacitors are lumped together as C_N in part B of figure 4-8. Figure 4-8A shows the elements of the neutralizing circuit, and figure 4-8B shows the neutralizing circuit arranged as the equivalent capacitance bridge circuit. The circuit is balanced when $\frac{C_N}{C15} = \frac{C_{gp},}{C_{gf},}$ where C_{gp} is the grid-to-plate capacitance of the power amplifier tubes and C_{gf} is the total input capacitance of the circuit, including the input interelectrode capacitance of the power amplifier tubes and all stray capacitance. Figure 4-9 is a graphical representation of the approximate settings of the PA TUNE controls for the various power amplifier operating frequencies (2 to 30 mc).

The 400-volt d-c is applied to the screen grids of power amplifier tubes V3 and V4 through their associated 100-ohm screen-current limiting resistors R11 and R12, respectively, and tube balance circuits, consisting of S11 and R40 through R43 for V3, and S12 and R44 through R47 for V4. The tube balance circuits vary the screen bias on the power amplifier tubes until proper tube balance is obtained.

(c) TGC CIRCUIT. - Some of the driving power is rectified in the power amplifier grid circuit, and the rectified audio energy is r-f filtered by R6, L5, and C45. The a-f energy is coupled through C52 to rectifiers CR2 and CR3, which are connected in a voltage doubler circuit. The d-c output voltage from CR2 and CR3 is connected to feedthrough capacitor C65 for delivery to the tgc circuits in the sideband generator.

(d) ALC CIRCUIT. - Part of the negative feedback signal from the power amplifier to the neutralizing circuit (C8 and C12) is developed across the capacitor voltage divider consisting of C70 and C71. The signal across C71 is applied to reversed biased diode CR5, which rectifies the r-f and passes a negative d-c voltage to the tgc/alc line.

The ALC adjustment varies a positive d-c voltage across CR5 which opposes that developed by the negative r-f feedback. This determines at what operating power the feedback voltage will cancel the opposing bias on CR5 and, therefore, the power point at which the alc threshold occurs.

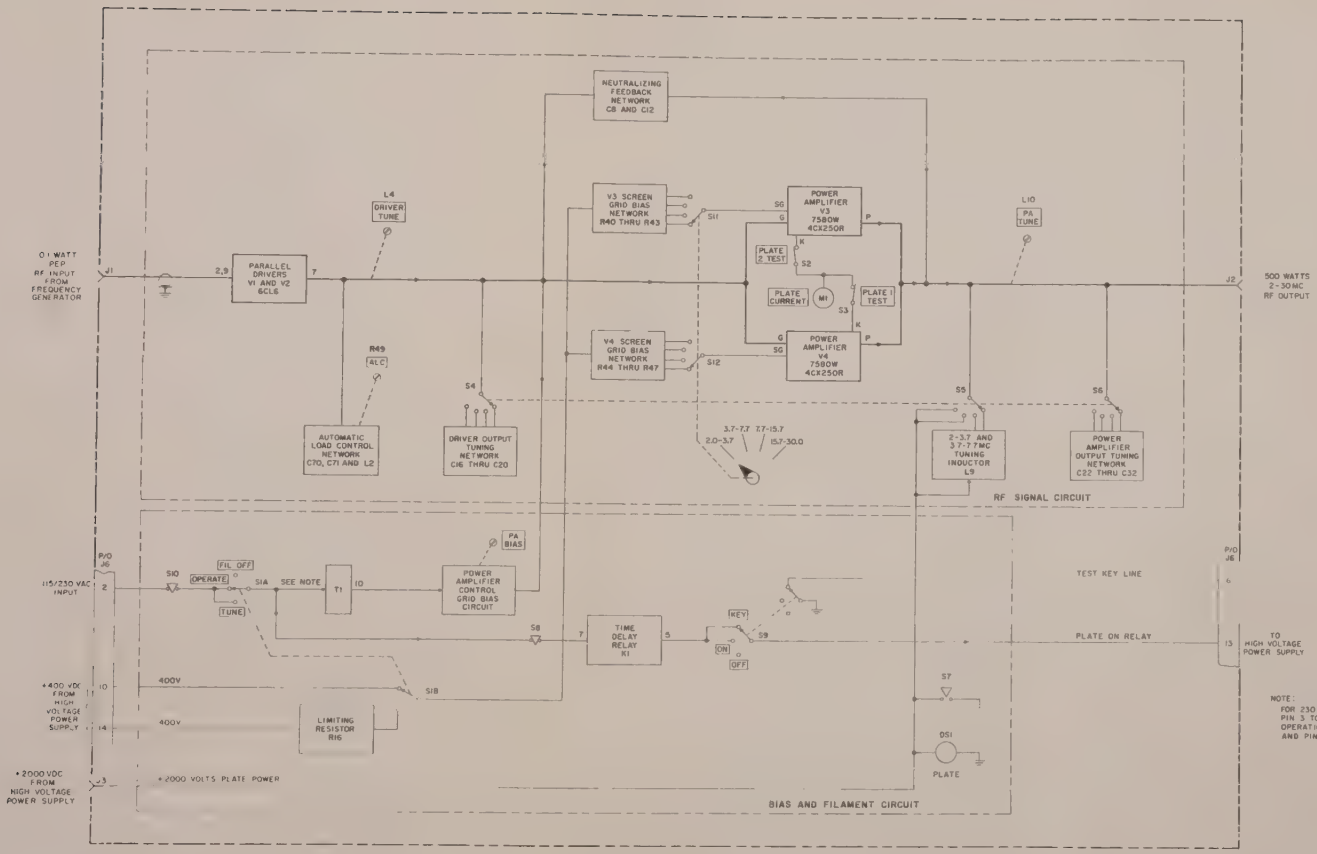
Under static conditions with no signal applied, no rf will be applied to CR5. If CR6 were not present, voltage of approximately +1 volt would be developed across the tgc amplifier input (the tgc amplifier has an input impedance of approximately 1 megohm). This 1 volt would reduce the tgc self-bias voltage, nullifying its intended effect. To avoid this, CR6 is included which clamps any positive voltage over 0.3 volt to ground. L12 and C72 are included to prevent rf from getting into the 400-volt d-c supply. C73 bypasses any possible rf from CR5 to ground.

(e) BIAS AND FILAMENT CIRCUITS. - Primary a-c power (115 or 230 volts) is connected to feedthrough capacitors C58 and C59. From C58 and C59, a-c power is connected through F1, interlock switch S10, and FIL OFF-TUNE-OPERATE switch S1-A to the primary winding of transformer T1. Transformer T1 may be connected for either 115- or 230-volt operation as shown on the schematic diagrams (figures 5-98 and 5-99). All filaments of the power amplifier are supplied from the 6.3-volt secondary winding of transformer T1 (V3 and V4 filament voltage is dropped to 6.0 volts by series resistor R14). The 115-volt a-c from the other secondary winding is applied through resistor R17 to rectifier CR1. Rectified d-c bias voltage is filtered by R18, C53, and C54 and applied to two resistive dividers. Approximately 45 volts from one of the dividers, consisting of R21 and R22, is applied to the grid circuits of the drivers, V1 and V2. The power amplifier grid bias voltage is taken from the slider of potentiometer R19, which, with resistor R18, makes up the second voltage divider.

(f) GRID BLOCK KEYING. - The key line connection for the coil of keying relay K2 is from feedthrough capacitor C63 through contacts of relay K3. These contacts are closed only when plate voltage is applied to the power amplifier tubes. When the key line is open, a negative 150 volts is applied to the grid of power amplifier tubes V3 and V4 through contacts 3 and 4 of keying relay K2. This negative bias keeps power amplifier tubes V3 and V4 from conducting while the key is open. Negative bias of approximately 45 volts is applied to the grid of driver tubes V1 and V2. This negative bias keeps driver tubes V1 and V2 cut off until the key line is closed and until the transmit interlock circuit is grounded. If r-f power is applied to the grids of driver tubes V1 and V2 when the key line is open, the negative 45 volts will hold V1 and V2 at cutoff, preventing them from conducting.

Relay K2 is energized when the key line is closed (grounded). When relay K2 is energized, one set of contacts removes the negative 150 volts from the grid of power amplifier tubes V3 and V4 and applies the operating power amplifier bias. Another set of contacts grounds the negative 45 volts, removing the bias from the grid of driver tubes V1 and V2 allowing the driver to function. Because of high resistance of voltage divider R21, no damage to circuit components will result when the negative 45 volts is grounded. Diode CR4 is included as a transient suppressor to prevent the discharge voltage of relay K2 from arcing across the contacts of K3. R39 maintains a bias voltage on V3 and V4 control grids during the switching time of K2.

(g) SWITCH AND INTERLOCK CIRCUITS. - Filament interlock S10 is mounted near the chassis hinge so that swinging the chassis away from


0.1 WATT
PEP
RF INPUT
FROM
FREQUENCY
GENERATOR
J1
2,9
PARALLEL
DRIVERS
V1 AND V2
6CL6
7
L4
DRIVER
TUNE
R49
ALC
AUTOMATIC
LOAD CONTROL
NETWORK
C70, C71 AND L2
S4
DRIVER OUTPUT
TUNING
NETWORK
C16 THRU C20
NEUTRALIZING
FEEDBACK
NETWORK
C8 AND C12
V3 SCREEN
GRID BIAS
NETWORK
R40 THRU R43
S11
V4 SCREEN
GRID BIAS
NETWORK
R44 THRU R47
S12
SG
G
POWER
AMPLIFIER
V3
7580W
4CX250R
P
K
PLATE
2 TEST
S2
PLATE
CURRENT
M1
PLATE 1
TEST
S3
K
G
SG
POWER
AMPLIFIER
V4
7580W
4CX250R
P
3.7-7.7
7.7-15.7
2.0-3.7
15.7-30.0
L10
PA
TUNE
S5
2-3.7 AND
3.7-7.7MC
TUNING
INDUCTOR
L9
S6
POWER
AMPLIFIER
OUTPUT TUNING
NETWORK
C22 THRU C32
J2
500 WATTS
2-30MC
RF OUTPUT
RF SIGNAL CIRCUIT
P/O
J6
115/230 VAC
INPUT
2
S10
FIL OFF
OPERATE
TUNE
S1A
SEE NOTE
T1
10
PA
BIAS
POWER
AMPLIFIER
CONTROL
GRID BIAS
CIRCUIT
S8
7
TIME
DELAY
RELAY
K1
5
KEY
ON
OFF
S9
+400 VDC
FROM
HIGH
VOLTAGE
POWER
SUPPLY
10
14
400V
400V
S1B
LIMITING
RESISTOR
R16
+2000 VDC
FROM
HIGH VOLTAGE
POWER SUPPLY
J3
+2000 VOLTS PLATE POWER
P/O
J6
TEST KEY LINE
6
PLATE ON RELAY
13
TO
HIGH VOLTAGE
POWER SUPPLY
S7
DS1
PLATE
BIAS AND FILAMENT CIRCUIT

NOTE:
FOR 230 VAC OPERATION JUMPER PIN 3 TO PIN 5 ON T1. FOR 115 VAC OPERATION JUMPER PIN 1 TO PIN 5 AND PIN 3 TO PIN 7 ON T1.

Figure 4-6. Radio Frequency Amplifier AM-2061/URT, Servicing Block Diagram

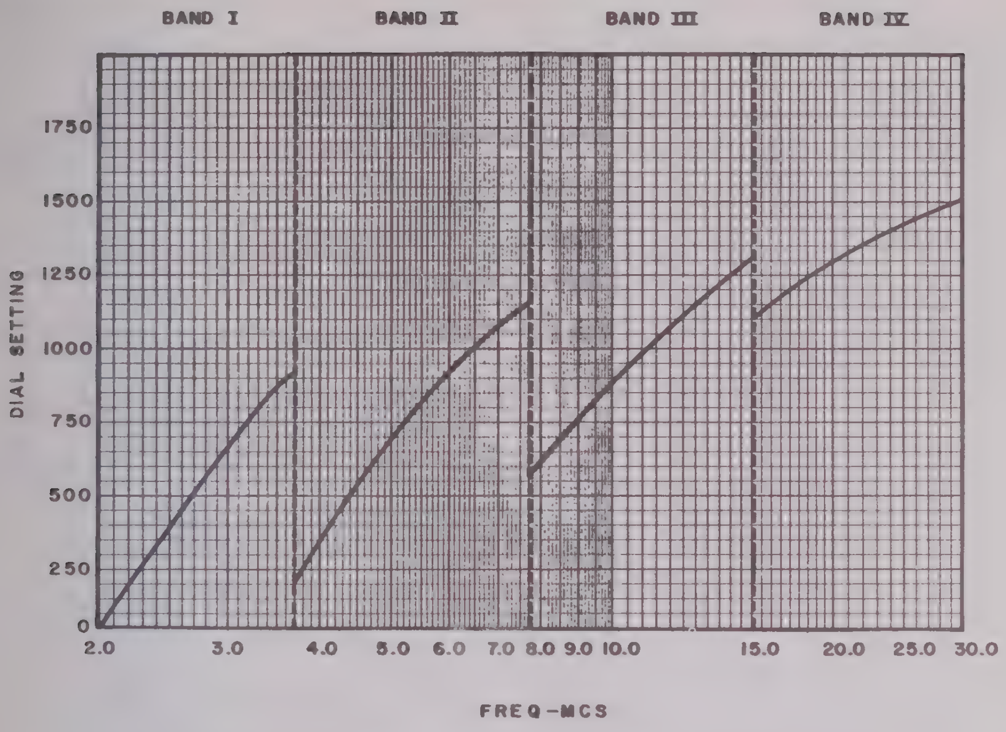
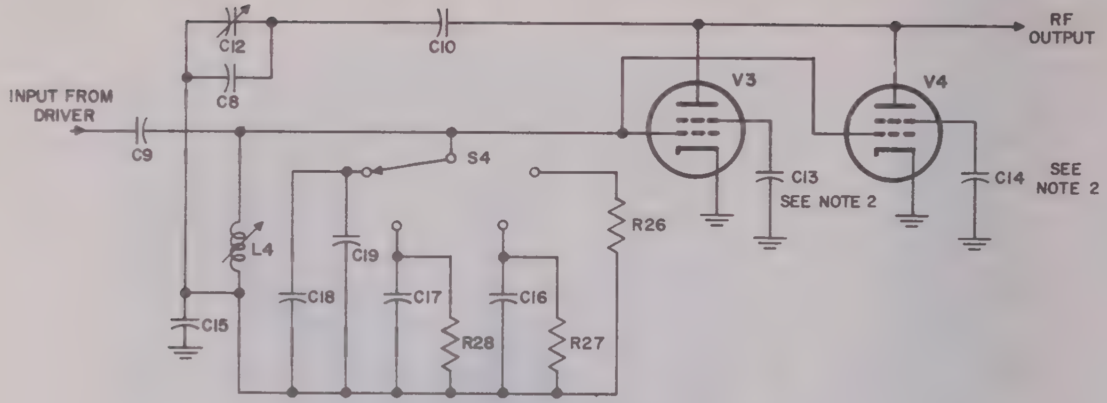


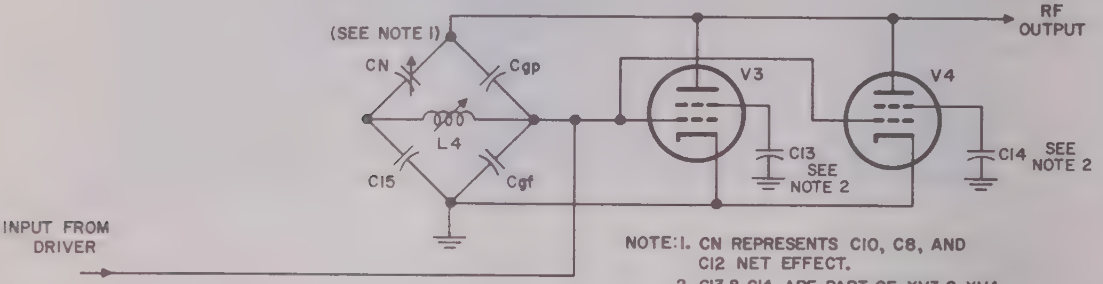
Figure 4-7. Drive Tuning Calibration Curve for AM-2061/URT

the rack and disconnecting the cooling air supply breaks the primary connection to transformer T1 and removes filament power. If the front panel is removed, the front panel interlock S8 opens and deenergizes the plate-on relay in the high-voltage power supply. When power is applied to the power amplifier (AM-2061/URT) by operating the FIL OFF-TUNE-OPERATE switch S1-A from FIL OFF to TUNE, 115 volts ac is applied to the heater of time-delay relay K1. After the 20-second delay time, K1 closes and applies 115 volts ac to PLATE switch S9 and feedthrough capacitor C61 for connection to the plate-on relay in the high-voltage power supply through other system interlock circuits. Positive 400 volts d-c from the high-voltage power supply is connected to feedthrough capacitor C62. When FIL OFF-TUNE-OPERATE switch S1-B is in TUNE position, the +400 volts dc is connected through dropping resistor R16 to driver plates and power amplifier screen grids. When S1-B is in OPERATE position, R16 is shorted out and full +400 volts dc is applied to driver plates and power amplifier screens.

c. CONVERTER-OSCILLATOR CV-731/URC. - Converter-Oscillator CV-731/URC (frequency generator) is an i-f to r-f translator during transmit function and r-f to i-f translator during receive function. The frequency generator also supplies a 100-kc and a 1-kc output for operation of the sideband generator (AM-2064/URC) and the frequency comparator (CM-126/UR) respectively. The frequency generator consists of a main chasis and plug-in modules. The modules are the reference oscillator, the frequency divider, the sidestep oscillator, the stabilized master oscillator, and the r-f tuner. Isolation Amplifier Module AM-1785/GRC replaces the reference oscillator when an external 100-kc frequency standard is used as the prime frequency standard for the equipment. In addition to these modules, 0.1 kc tuning module is used in the frequency generator in the Radio Set AN/URC-32B Systems. During transmit condition, the r-f tuner module accepts the 300-kc single-sideband signal from the sideband generator and translates it to any desired one-kilocycle frequency point in the range of 2.0 to 30.0 mc. During receive condition, the r-f tuner module translates a received signal in the same frequency range to a 300-kc i-f frequency for demodulation by the sideband generator. The r-f tuner module performs a single-frequency conversion on the 2.0 to 3.7-mc band and a dual frequency conversion on the 3.7- to 30.0-mc bands. The frequency injection necessary for this conversion is supplied to the r-f tuner module by the stabilized master oscillator (SMO) module. The SMO module supplies an injection frequency of 2 to 4 mc in 1/8-kc steps. The SMO module consists of a tuned master oscillator and a frequency correction circuit. The SMO frequency correction circuit compares the master oscillator output to a frequency standard and corrects any



A. BASIC INPUT AND NEUTRALIZING CIRCUIT



NOTE: 1. CN REPRESENTS C10, C8, AND C12 NET EFFECT.
2. C13 & C14 ARE PART OF XV3 & XV4.

B. EQUIVALENT BRIDGE CIRCUIT

Figure 4-8. Neutralizing Circuit for AM-2061/URT

error in the master oscillator. The reference oscillator, frequency divider, and sidestep oscillator modules supply injection signals for the operation of the SMO correction circuit. The reference oscillator serves as a frequency standard for the frequency generator. If an external frequency standard is used, the reference oscillator module is replaced with an isolation amplifier module (AM-1785/GRC). Figure 4-10 is a functional block diagram of the frequency generator, a general discussion of the modules follows:

The reference oscillator module provides the basic reference frequencies of 100 kc and 2.4 mc for the entire equipment. The reference oscillator signal is generated by a 3-mc, crystal-controlled oscillator. The oscillator crystal is enclosed in a temperature-controlled electronic oven. The oven control circuit consists of a transistorized audio-frequency amplifier tuned to 5 kc, with a positive feedback from output to input through a temperature sensitive bridge. As a result of the positive feedback, the amplifier oscillates, thus delivering a-c power to the bridge which also acts as an oven heater. As the oven bridge heats, the bridge approaches the point where the attenuation of the bridge equals the gain of the amplifier, at which time, steady-state oscillation exists. This point is a few hundredths of a degree below the true balance temperature of the bridge and is independent of the power required to maintain this temperature. The oven has no temperature cycling and will hold the temperature of the oven, and therefore the crystal, within 0.1°C over an ambient temperature range of -55°C (-67°F) to +70°C (+158°F). The 3-mc output of the crystal oscillator is coupled to a regenerative divider circuit consisting of subtractive mixer Q7 and times 4 multiplier Q10. The 2.4-mc output of this divider is fed to the sidestep oscillator module through output amplifier Q12. The 600-kc output of the divider is fed through buffer amplifier Q8 to another regenerative divider consisting of subtractive mixer Q9 and times 5 multiplier Q11. The 100-kc output of the divider is amplified by output amplifier Q13 and used as the equipment frequency standard having a long-term stability of one part per million.

The frequency divider module supplies a 4-kc signal to the SMO module and a 1-kc signal to the sidestep oscillator module. The module consists of an amplifier and three multivibrator-type frequency dividers. The 100-kc signal from the reference oscillator module is amplified by Q1 and divided to 20 kc by multivibrator Q2 and Q3. The 20-kc signal is divided to 4 kc by the multivibrator, Q4 and Q5, and the 4-kc signal is divided to 1 kc by the multivibrator, Q6 and Q7. Since the 4-kc and 1-kc signals are derived from the 100-kc input signal, their ac-

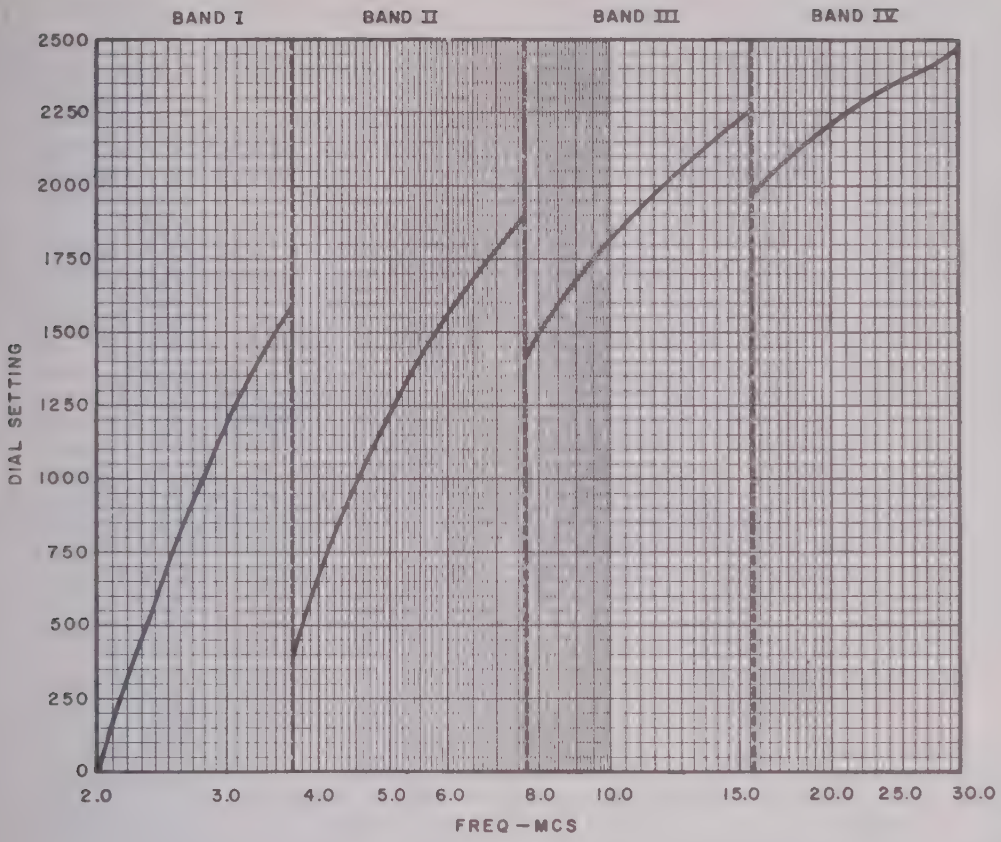


Figure 4-9. Plate Tuning Calibration Curve for AM-2061/URT

curacy stability is equal to that of the reference oscillator.

The sidestep oscillator module provides the injection frequency for the second mixer of the SMO module. This injection frequency is sidestepped by 1, 2, or 3 kc to obtain the electronic tuning necessary to supplement the mechanical tuning of the SMO module master oscillator. The sidestep oscillator is not used on BAND 1, BAND 2, BAND 3 ADD 0, and BAND 4 ADD 0. On these bands, the 2400-kc signal from the reference oscillator module is fed directly to the second mixer of the SMO by relay K1. When the band switch is in the ADD 1, ADD 2, or ADD 3 position, relay K1 is energized and the output of the sidestep oscillator is fed to the second mixer of the SMO. On BAND 4 ADD 1, the sidestep oscillator output frequency is 2399 kc. On BAND 4 ADD 2 and BAND 3 ADD 1, the output frequency is 2398 kc. On BAND 4 ADD 3, the output frequency is 2397 kc.

The sidestep oscillator consists of a pulse generator, a subtractive mixer, a band-pass filter, an additive mixer, and a crystal-controlled oscillator operating on one of four frequencies spaced 1-kc apart. The pulse generator is driven by a 1-kc signal from the frequency divider and produces a 1-kc keying pulse that is used to key subtractive mixer V1 into conduction at a 1-kc rate. This action causes the 2.4-mc signal, injected to the mixer from the reference oscillator module, to have a 1-kc spectrum impressed upon it in the mixer tube. The subtractive mixer also receives an injection signal from the crystal-controlled oscillator which may be 1.945, 1.944, 1.943, or 1.942 mc, depending on the control of crystal selection relays K1 and K2. This crystal oscillator signal is beat with a 1-kc spectrum point of the 2.4-mc signal to produce a 455-kc difference frequency. A band-pass mechanical filter immediately following the subtractive mixer has adequate rejection to adjacent 1-kc spectrum points but a sufficient band-pass width to accommodate the crystal oscillator error. The 455-kc signal, plus or minus any oscillator error, is amplified by an amplifier stage and applied to an additive mixer. The crystal oscillator signal also is injected into the additive mixer and combines with the 455-kc signal to produce a sidestep output signal on one of four frequencies: 2.400, 2.399, 2.398, or 2.397 mc (the 2.400-mc output is not used in the AN/URC-32( ) equipments). The use of a subtractive mixer and then an additive mixer cancels the crystal oscillator error, resulting in a sidestep oscillator stability equal to the reference oscillator.

The stabilized master oscillator (SMO) module consists of a master oscillator and a stabilizing loop that provides error correction for the master oscillator. The master oscillator is an inductance-tuned oscillator that can be mechanically positioned in 0.5-kc increments through the frequency range of 2 to 4 mc. Consequently, it is capable of being tuned directly to the 2000 increments required to produce 1-kc r-f tuner module channels in band 1 and the 4000 increments required to produce 1-kc r-f tuner module channels in band 2. Bands 3 and 4 of r-f tuner module, containing 8,000 and 16,000 1-kc channels, respectively, require the master oscillator to produce a greater number of injection frequencies than are possible with the mechanical positioning device. Generation of the additional increments is accomplished by mechanically positioning the master oscillator to the nearest lower 0.5-kc increment and then operating the stabilizing loop to position the master oscillator electronically to the additional required increments. Electronic tuning of the master oscillator is accomplished by varying the d-c voltage applied to a voltage sensitive-capacitor located in the tuning circuit of the master oscillator. The master oscillator output frequency can be determined by the following formula:

$$F_{MO} = \frac{\text{DIAL} + \text{ADD} + 300}{\text{BAND MULT}}$$

Where: F_{MO} = the master oscillator frequency in kilocycles
DIAL = the frequency generator dial frequency
300 = the 300-kc fixed i-f subtracted in the r-f tuner i-f mixer
BAND MULT = Multiplication of the master oscillator frequency in the r-f tuner module
Band 1 = 1
Band 2 = 2
Band 3 = 4
Band 4 = 8
ADD = The ADD KC indication on the BAND-CHANGE switch.

The master oscillator stabilizing loop electronically tunes the master oscillator to the desired frequency and phase locks it to the reference oscillator thereby maintaining a master oscillator accuracy and stability equal to that of the reference oscillator module. This is accomplished by comparing the master oscillator signal to the reference oscillator signal in a frequency and phase discriminator. The stabilizing loop sequence is as follows: The 2- to 4-mc output of the master oscillator is multiplied by eight and applied to mixer V2 where it is beat with a selected 100-kc spectrum point from the 100-kc spectrum generator. The triggering signal for the 100-kc spectrum generator is obtained from the reference oscillator module. The output of mixer V2 is filtered to obtain a difference frequency between 3.4 and 3.5 mc and applied to mixer A3V1 where it is beat with a signal from the sidestep oscillator module or reference oscillator module. The sidestep oscillator injection is used to obtain electronically the frequency increments that cannot be obtained by mechanically tuning the master oscillator. The output of mixer A3V1 is filtered to obtain a difference frequency between 970 and 1130 kc and applied to mixer A3V2 where it is beat with a signal from the interpolation oscillator. The interpolation oscillator, which is tuned by the mechanical tuning shaft, supplies an injection signal which will produce a mixer A3V2 difference frequency, the signal i-f of 455 kc plus the master oscillator error and the interpolation oscillator error. The filtered output of mixer A3V2 is applied to the signal i-f amplifier and the phase and frequency discriminator where it is compared with the 455-kc reference i-f frequency. The reference i-f frequency is generated by converting a 4-kc signal from the frequency divider module to a 4-kc spectrum in the 1000- to 1100-kc range and mixing it with the interpolation oscillator signal to obtain a reference signal of 455 kc plus the interpolation oscillator error. The interpolation error which is present in both the reference and signal i-f frequencies is balanced out in the phase and frequency discriminator. During setup, the master oscillator frequency is incorrect, resulting in the signal i-f being above or below 455 kc and the frequency discriminator develops a d-c voltage which pulls the master oscillator toward the proper frequency. When the signal i-f frequency reaches 455.0 kc, phase discrimination results in an electrical tuning d-c voltage output which phase locks the master oscillator on frequency. In the phase lock condition, the master oscillator output assumes the correct phase, ϕ_{COR}, so that the phase discrimination with ϕ_{REF} produces an output which maintains equilibrium in the stabilizing loop and holds the master oscillator on frequency. In the phase lock condition, F_{MO} tracks F_{REF} resulting in a master oscillator stability equal to the reference frequency stability.

The r-f tuner module is an i-f to r-f translator during transmit condition and an r-f to i-f translator during receive condition. The i-f is 300 kc, and the r-f is manually tuned in 1-kc steps over the frequency range of 2.0 to 30.0 mc in four bands: Band 1, 2.0 to 3.7 megacycles; band 2, 3.7 to 7.7 megacycles; band 3, 7.7 to 15.7 megacycles, and band 4, 15.7 to 30.0 megacycles. On band 1, the r-f tuner module performs a single-frequency conversion. On bands 2, 3, and 4, the r-f tuner module performs a double-frequency conversion. On receive operation, the r-f input signal from the transmit-receive relay is fed through keying relay K2 to receive r-f amplifier V8. On bands 2, 3, and 4, the output of V8 is fed to receive h-f mixer V3B where it is converted to a 1.7- to 3.7-mc variable i-f signal. On band 1, the output of V8 is fed directly to receiver i-f amplifier V7. The 1.7- to 3.7-mc variable i-f signal is amplified by receiver i-f amplifier V7 and fed to receiver i-f mixer V1B where it is converted to a 300-kc fixed i-f signal and fed to the sideband generator. An agc voltage from the sideband generator controls the gain of receiver amplifiers V7 and V8. On transmit operation, the 300-kc fixed i-f signal from the sideband generator is converted to a 1.7- to 3.7-mc variable

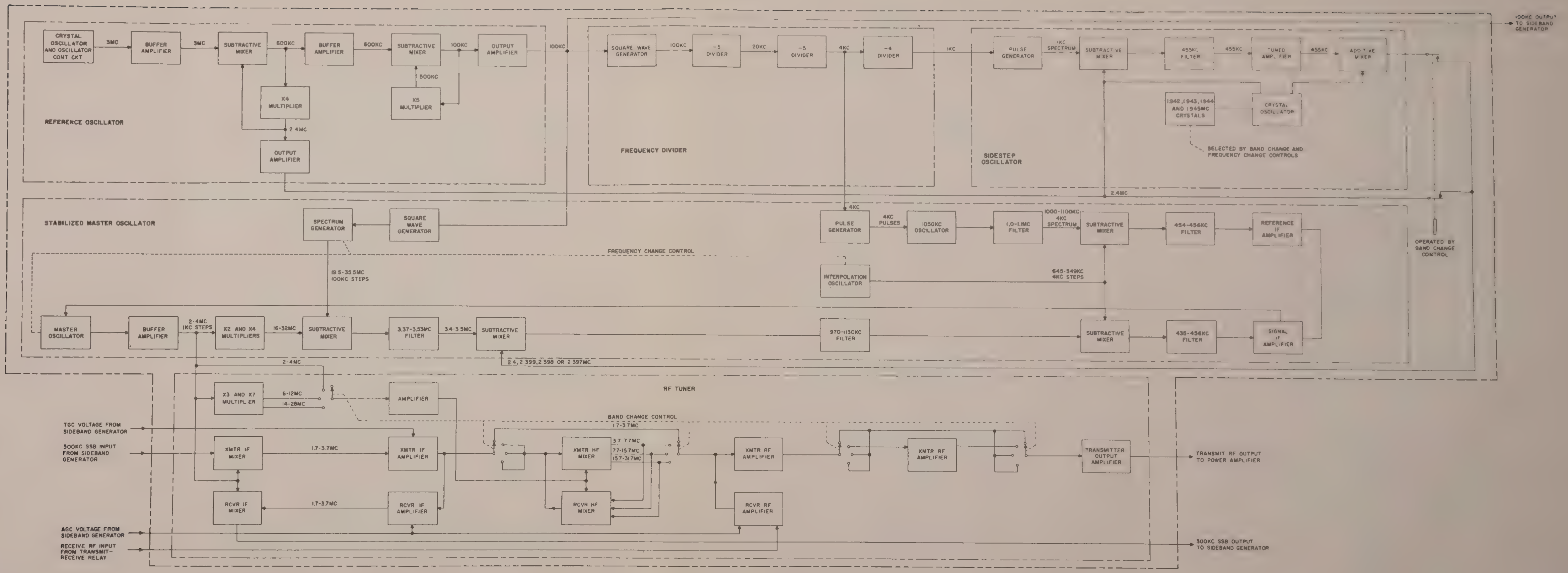

CRYSTAL OSCILLATOR AND OSCILLATOR CONT CKT
3MC
BUFFER AMPLIFIER
3MC
SUBTRACTIVE MIXER
600KC
BUFFER AMPLIFIER
600KC
SUBTRACTIVE MIXER
100KC
OUTPUT AMPLIFIER
100KC
X4 MULTIPLIER
500KC
X5 MULTIPLIER
REFERENCE OSCILLATOR
2 4MC
OUTPUT AMPLIFIER
SQUARE WAVE GENERATOR
100KC
÷5 DIVIDER
20KC
÷5 DIVIDER
4KC
÷4 DIVIDER
1KC
FREQUENCY DIVIDER
PULSE GENERATOR
1KC SPECTRUM
SUBTRACTIVE MIXER
455KC FILTER
455KC
TUNED AMPLIFIER
455KC
ADDITIVE MIXER
100KC OUTPUT TO SIDEBAND GENERATOR
1.942, 1.943, 1.944 AND 1.945MC CRYSTALS
CRYSTAL OSCILLATOR
SELECTED BY BAND CHANGE AND FREQUENCY CHANGE CONTROLS
SIDESTEP OSCILLATOR
2.4MC
STABILIZED MASTER OSCILLATOR
SPECTRUM GENERATOR
SQUARE WAVE GENERATOR
4KC
PULSE GENERATOR
4KC PULSES
1050KC OSCILLATOR
1.0-1.1MC FILTER
1000-1100KC 4KC SPECTRUM
SUBTRACTIVE MIXER
454-456KC FILTER
REFERENCE IF AMPLIFIER
OPERATED BY BAND CHANGE CONTROL
FREQUENCY CHANGE CONTROL
19.5-35.5MC 100KC STEPS
INTERPOLATION OSCILLATOR
645-549KC 4KC STEPS
MASTER OSCILLATOR
BUFFER AMPLIFIER
2-4MC 1KC STEPS
X2 AND X4 MULTIPLIERS
16-32MC
SUBTRACTIVE MIXER
3.37-3.53MC FILTER
3.4-3.5MC
SUBTRACTIVE MIXER
970-1130KC FILTER
SUBTRACTIVE MIXER
435-456KC FILTER
SIGNAL IF AMPLIFIER
2-4MC
2.4, 2.399, 2.398 OR 2.397MC
RF TUNER
X3 AND X7 MULTIPLIER
6-12MC
14-28MC
AMPLIFIER
BAND CHANGE CONTROL
1.7-3.7MC
TGC VOLTAGE FROM SIDEBAND GENERATOR
300KC SSB INPUT FROM SIDEBAND GENERATOR
XMTR IF MIXER
1.7-3.7MC
XMTR IF AMPLIFIER
XMTR HF MIXER
3.7-7.7MC
7.7-15.7MC
15.7-31.7MC
XMTR RF AMPLIFIER
XMTR RF AMPLIFIER
TRANSMITTER OUTPUT AMPLIFIER
TRANSMIT RF OUTPUT TO POWER AMPLIFIER
RCVR IF MIXER
1.7-3.7MC
RCVR IF AMPLIFIER
RCVR HF MIXER
RCVR RF AMPLIFIER
AGC VOLTAGE FROM SIDEBAND GENERATOR
RECEIVE RF INPUT FROM TRANSMIT-RECEIVE RELAY
300KC SSB OUTPUT TO SIDEBAND GENERATOR

Figure 4-10. Converter-Oscillator CV-731/URC, Functional Block Diagram

i-f signal by transmit i-f mixer V1A. This signal is amplified by transmit i-f amplifier V2. The gain of V2 is controlled by a transmit gain control (tgc) voltage from the sideband generator. On band 1, the output of V2 is fed through the band-change switch to transmit r-f amplifier V4. On bands 2, 3, and 4, the output of V2 is fed through the band-change switch to transmit h-f mixer V3B where it is converted to an r-f signal in the range of 3.7 to 30.0 mc. The transmit h-f mixer V3B is followed by three stages of amplification on band 2 and two stages of amplification on bands 1, 3, and 4. The r-f output is fed to the power amplifier.

Injection signals for the r-f tuner module mixers are obtained from the SMO modules. The 2- to 4-mc output signal of the SMO module is fed directly to the transmit and receive i-f mixers on all bands. On band 2, the 2- to 4-mc SMO signal also is fed to the receive and transmit h-f mixers through amplifier V10. On band 3, the SMO signal is tripled by multiplier V9 to obtain an h-f mixer injection signal of 6 to 12 mc. On band 4, multiplier V9 multiplies the SMO signal by 7 to obtain an h-f mixer injection signal of 14 to 28 mc.

The isolation amplifier module (AM-1785/GRC) replaces the reference oscillator module when an external 100-kc standard is used. For the schematic diagram, see figure 5-110. The isolation amplifier module provides isolation from the external standard and, in addition to the 100-kc output, supplies the 2.4-mc signal required for operation of the sidestep oscillator and stabilized master oscillator modules. The isolation amplifier module consists of a 100-kc amplifier, a times 6 multiplier, and a times 4 multiplier. The 100-kc amplifier provides isolation between the 100-kc standard input and the 100-kc isolation amplifier output. In addition, the 100-kc amplifier supplies a signal to the times 6 multiplier. The 600-kc output of the times 6 multiplier is fed to a times 4 multiplier which provides a 2.4-mc output for the sidestep oscillator module.

The 0.1-kc tuning module which is used only on Radio Set AN/URC-32B provides 0.1-kc incremental tuning on any band by translating the intermediate frequency to any of 10 frequencies differing by a multiple of 100 cps from the original frequency. This tuning is controlled manually by a 10-position (0 through 9) thumb wheel switch. The 0 position leaves the intermediate frequency unchanged.

(1) FUNCTIONAL TEST DATA. - The following information provides over-all functional test data and equipment required for the frequency generator unit.

(a) DETERMINING OVER-ALL PERFORMANCE. - Refer to servicing block diagram figure 4-11. The following operational checks are to be performed on the frequency generator modules:

1. STABILIZED MASTER OSCILLATOR (SMO) MODEL C. The AFC meter on the front panel of the frequency generator provides visual means of checking for stabilizing loop correction. The deflection of the meter is proportional to the frequency correction of the master oscillator by the SMO stabilizing loop. Rotate the FREQUENCY CHANGE control through the entire band. The SMO should be checked if the AFC meter deflection is greater than the following values:

BAND 1 FREQUENCY	MAXIMUM AFC
Up to 2.0 mc	90 ua
2.0 to 2.5 mc	80 ua
2.5 to 3.0 mc	70 ua
3.0 to 3.7 mc	50 ua

When the OPERATE-TUNE-switch is placed in the TUNE position (disabling SMO loop), the AFC meter should return to approximately zero reading. If the meter reads zero at all frequencies when the OPERATE-TUNE switch is in the OPERATE position, the stabilizing loop is not correcting the master oscillator or the meter circuit is defective. Operation of the SMO loop also can be checked by loosely coupling the SMO output (test point J13 on SMO) to a communications receiver in the 2- to 4-mc range. (The SMO frequency should be 300 kc above the band 1 dial reading.) When the SMO frequency is changed by moving the FREQUENCY CHANGE control in either direction, frequency steps of 500 cps should be heard in the receiver. When the OPERATE-TUNE switch is placed in the TUNE position and the FREQUENCY CHANGE control is turned, a normal nonstepping, continuously variable, beat note should be heard, indicating the SMO loop is disabled.

2. SIDESTEP OSCILLATOR OPERATION. - While observing the AFC meter, the deflection should move about one division when switching from band 3-0 to 3-1. Deflection of about one-half division should be observed when switching from bands 4-0 to 4-1, 4-1 to 4-2, and 4-2 to 4-3. The amount of deflection is nominal, but perception of the deflection is an indication of a change in the master oscillator frequency. If these deflections do not occur, check sidestep oscillator circuit or SMO operation.

3. R-F TUNER OPERATION.

a. Operate the TUNE-LOCAL-EXTERNAL CONTROL switch on the sideband generator to the TUNE (carrier reinsert) position. Operate meter switch to RF OUT EXCITER position. Operate EXCITER RF GAIN control fully counterclockwise.

b. Key exciter with XMIT-REC-CW TEST switch on CW and FSK unit. Turn EXCITER RF GAIN control clockwise, and note that meter on the sideband generator reads at least 40 db. If the meter reads less than 40 db, check r-f tuner module or carrier reinsert adjustment (sideband generator adjustments).

4. CALIBRATION CHECKS. - Frequency calibration of the equipment is checked by using Signal Comparator CM-126/UR (frequency comparator) and the following step-by-step procedure to determine the accuracy of the 100-kc reference oscillator in the CV-731/URC. This is accomplished by comparison of the internal and an external 100-kc standard.

a. Connect an external 100-kc frequency standard signal, at a level of 1 volt, to J2 on the frequency comparator.

b. Turn GAIN control fully counterclockwise.

c. Set FREQUENCY SELECTOR to the 100 kc position.

d. Adjust METER ZERO control for zero meter reading.

e. Turn GAIN control clockwise for noticeable meter deflection.

f. Clock the time required for the meter to make N complete cycles (a complete cycle is from maximum on one side to maximum on the other and back to the original position); determine the frequency difference using the following relationship:

$$\text{Frequency difference} = \frac{10N}{T} \text{ parts per million}$$

where frequency is 100 kc
T is time in seconds
N is number of complete cycles in T seconds

g. If the difference exceeds one part per million, continue this procedure.

h. Adjust L1 on the reference oscillator module until the beat-frequency deflection on the CM-126/UR meter is noted. Adjust L1 for minimum deflection rate. The number of complete cycles of meter deflection per second indicates the frequency error in cycles per second. Monitor the error by comparing audio tones on the equipment speaker or dynamic handset.

5. TROUBLE ISOLATION. - The proper procedure for trouble isolation is to first isolate the trouble to a defective module. Table 4-1 lists the test-point voltages for locating a defective module using signal-tracing procedures. See figure 5-43 for test-point location. If the isolation amplifier is being used, a 100-kc signal is injected into the isolation amplifier. Test-point voltages are taken with the frequency generator installed in an operating system. All voltage measurements, except J1 on the r-f tuner module, were made with a vtvm (AN/USM-143). The measurement at J1 on the r-f tuner was made with a vtvm (AN/USM-143). After the trouble has been isolated to a defective module, the module may be replaced with an operable module or may be repaired by isolating the trouble to a defective part in the module.

Once trouble has been isolated to a module, conventional trouble-shooting procedures can be used to locate a defective part with the aid of the module schematic diagrams and the oscilloscope waveforms of table 4-2. Pendant cables and extension boards may be used to connect the module or subassembly to the chassis for accessibility and convenience during testing. Table 4-3 lists the transmit, receive, and injection signal levels for each band of the r-f tuner module. The transmit and receive levels given are the signal generator level necessary at each test jack to produce a 20-db R-F OUT and a 20-db agc reading (respectively) on meter M1 of the sideband generator. These measurements are made with RECEIVER RF GAIN control and EXCITER RF GAIN control (on sideband generator) set at maximum. All other controls are left at normal operating settings. A 20-db agc reading on M1 corresponds to an agc bus voltage of -2.6 volts as read on a d-c vacuum-tube voltmeter, and a 20-db RF OUT reading corresponds to 1.58 volts rf at J10 on the chassis (J10 termination in 50 ohms). For receive input injections to J11 on the chassis, a 33-ohm resistor is connected in series with the signal generator signal lead. All readings are in microvolts unless otherwise indicated. Injection levels are the same for transmit or receive function. Table 4-4 gives complete trouble-isolation procedures for the stabilized master oscillator module.

(b) EQUIPMENT AND TOOLS REQUIRED FOR FUNCTIONAL TESTING. - The test equipment and tools required for testing on the overall functional level are listed in table 4-5.

(c) ADJUSTMENTS AND ALIGNMENTS. The adjustments and alignments necessary for proper operation of the frequency generator are as follows: r-f tuner alignment (paragraph 5-2b(2)(a)), r-f and i-f circuit alignment, transmit function (paragraph 5-2b(2)(a)1), r-f and i-f circuit alignment, receive function (paragraph 5-2b(2)(a)2), reference oscillator module alignment (paragraph 5-2b(2)(b)), sidestep module alignment (paragraph 5-2b(2)(c)), 0.1 kc tuning module alignment (paragraph 5-2b(2)d) and the stabilized master oscillator alignment (paragraph 5-2b(2)(e)).

(2) DETAILED CIRCUIT DESCRIPTION. - The detailed circuit description of this unit is discussed on a module basis. Refer to CV-731/URC servicing block diagram figure 4-11. In addition appropriate references are made to the schematic diagram of the particular module under discussion.

(a) R-F TUNER MODULE. There are two models of the r-f tuner module used in Radio Set AN/URC-32( ), model A and model B. Model B r-t tuner is an improved version of the model A and is interchangeable with the model A. The basic differences are that model B uses conventional coils, while model A uses molded coils, and model B has improved gain characteristics over those of model A. Refer to figure 5-102, the schematic diagram of the model A r-f tuner, and to figure 5-103, the schematic of the model B r-f tuner. The following r-f tuner transmit and receive function circuit descriptions apply to both r-f tuner models.

(b) R-F TUNER MODEL, TRANSMIT FUNCTION. The 300-kc i-f signal is coupled to the control grid of the transmitter low-frequency mixer, V1A. The 300-kc i-f signal mixes with the 2.0- to 4.0-mc injection signal from the SMO module to produce 1.7- to 3.7-mc output from mixer V1A. The 2.0- to 4.0-mc injection frequency is coupled from pin 2 of receptacle P1 through a parallel-tuned circuit consisting of C118, C119, C120, and the primary winding of transformer T7. Output is taken from the secondary winding of T7 and coupled through capacitor C94 for cathode injection into V1A. Since V1A is a subtractive mixer, the injection of the 300-kc i-f signal and the 2.0- to 4.0-mc signals produces an output of 1.7 to 3.7 mc, or the variable i-f frequency band. The output from V1A plate is tuned by Z1, Z2, and Z3 and coupled through C11 to the control

TABLE 4-1. TROUBLE ISOLATION TO MODULE

TEST POINT	FREQUENCY	NORMAL SIGNAL	IF SIGNAL IS ABNORMAL
FREQUENCY DIVIDER MODULE			
J1	100 kc	1.5 volts ac	Check reference oscillator module or isolation amplifier module.
J2	4 kc	1.0 volt ac	Check frequency divider module.
J3	1 kc	1.0 volt ac	Check frequency divider module.
SIDESTEP OSCILLATOR MODULE			
J1	2.4 mc	1.0 to 1.5 volts ac	Check reference oscillator module.
J2	2.4 mc	0.4 to 1.0 volt ac (on bands 3-1, 4-1, 4-2, 4-3)	Check sidestep oscillator module and relay K1 on CV-731/URC chassis. **Note** Normal condition shows no readings on bands 1 and 2 3-0, and 4-0.
STABILIZED MASTER OSCILLATOR MODULE			
J2	100 kc	1 to 3 volts dc	Check reference oscillator module.
J13	2 to 4 mc	0.8 to 3.0 volts rms	Check stabilized master oscillator (SMO) module.
J3	D-c	-3 to -8 volts dc **Note** Bias may be -6 to -20 volts dc depending on date of manufacture.	Check SMO r-f tuner subassembly frequency multiplier CR1-CR4.
J12	30.448 mc (MO at 3.806 mc)	0.5 to 3.0 volts rms	Check SMO r-f tuner subassembly frequency multiplier V1.
A7J1	445 kc	1.5 to 10 millivolts ac	Check SMO 4-kc spectrum generator subassembly.
A7J2	D-c	*+0.4 to +0.6 volts dc	Check SMO reference i-f amplifier subassembly.

TABLE 4-1. (Continued)

TEST POINT	FREQUENCY	NORMAL SIGNAL	IF SIGNAL IS ABNORMAL
A2J1	455 kc	3.75 to 4.0 volts rms	Check SMO signal i-f amplifier, i-f mixers, or interpolation oscillator subassemblies.
A2J2	D-c	*+0.4 to +0.6 volts dc	Check SMO signal i-f amplifier, i-f mixers, or interpolation oscillator subassemblies.
R-F TUNER MODULE			
J1	300 kc	15 mv rms (keyed and carrier reinserted)	Check carrier generator module in sideband generator.
**M1 (RF OUT)	2 to 30 mc	At least 40 db (keyed with carrier reinserted, EXCITER R-F GAIN at maximum)	Check transmit operation of r-f tuner module.
**M1 (AGC)	2 to 30 mc	About 40 db (100 uv applied at J12, RECEIVER R-F GAIN at maximum)	Check receive operation of r-f tuner module.

*These values are critical. If reading is more than 0.6 volts, SMO correction loop is probably not operating.

**Meter M1 is located on the front panel of the sideband generator.

TABLE 4-2. OSCILLOSCOPE WAVEFORMS

HORIZONTAL		VERTICAL		WAVEFORM DESCRIPTION
TEST POINT	FREQUENCY	TEST POINT	FREQUENCY	
REFERENCE OSCILLATOR MODULE				
Q7-e	3 mc	Q9-e	600 kc	Five-lobe Lissajous pattern (5 to 1)
Q9-e	600 kc	P1-F	100 kc	Six-lobe Lissajous pattern (6 to 1)
FREQUENCY DIVIDER MODULE				
Sweep	100 kc	Q1-c	100 kc	Clipped sine wave
*Q3-c	20 kc	Q1-c	100 kc	Five-lobe Lissajous pattern (5 to 1)
*Q5-c	4 kc	*Q3-c	20 kc	Five-lobe Lissajous pattern (5 to 1)
*Q7-c	1 kc	*Q5-c	4 kc	Four-lobe Lissajous pattern (4 to 1)

*Connect through a 330K-ohm resistor.

TABLE 4-3. R-F TUNER MODULE, SIGNAL LEVELS

TEST POINT (See figure 5-4.)	SIGNAL VOLTAGE			
	BAND 1	BAND 2	BAND 4	BAND 3
*Transmit Levels				
J1	1700	3000	330	15,000
J3	750	6500	10,000	18,000
J5	---	14,000	16,000	28,000
J6	11,500	9000	27,000	32,000
J7	---	170,000	---	---
J8	220,000	200,000	330,000	330,000
*Receive Levels				
J11 (on chassis)	10	14	7	20
J13	42	130	85	49
J12	---	800	400	400
J10	525	750	700	600
J2	12,000	12,000	12,000	12,000
Injection Levels				
J9	2.5 v	2.5 v	2.5 v	2.5 v
J14	53.0 v	53.0 v	53.0 v	53.0 v
J15	---	2.5 v	1.2 v	3.6 v
J11	---	10.5 v	3.0 v	3.0 v

*The levels given for transmit and receive are typical but not necessarily precise. They are intended to show stage gain. All readings are nominal and may vary considerably from unit to unit or from band limit to band limit. Readings were taken at alignment frequencies (1.900 mc on BAND 1, 4.100 mc on BAND 2, 8.500 mc on BAND 3, and 17.300 mc on BAND 4). Leave FREQUENCY CHANGE control set so BAND 4 window reads 17.300 mc, and change bands with the BAND CHANGE control. See figure 5-4 for test jack location.

TABLE 4-4. STABILIZED MASTER OSCILLATOR TROUBLE-ISOLATION CHART

PRELIMINARY INSTRUCTIONS

If test 1 checks out completely, it is not necessary to perform the succeeding tests. If test 1 does not check out, perform those tests which apply to the defective section of the stabilized master oscillator (SMO). Omit tests 8 and 9 for models B and C SMO. Omit tests 6 and 7 for model A SMO. Tests 1 through 5 apply to all models.

TEST NO. 1. OVER-ALL CHECK

In the following procedure, monitor the SMO frequency as follows: Connect a short piece of coaxial cable to antenna terminals of the communications receiver. Remove about 2 inches of braid from the coaxial cable. Remove dust cover from the frequency generator and drop frequency dial panel. Hand the coaxial cable over the r-f tuner module slug rack, but do not make a metallic connection to the chassis. Tip frequency dial panel up into position again (the frequency changes slightly when the dial panel is lowered).

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	NORMAL INDICATION	REMARKS
1A	Connect ME-26A/U for a-c operation at J2 of SMO.	J2	ON-OFF switch to ON.	1 to 3 volts ac	
1B	Connect a vtvm (ME-26A/U) for a-c operation at J13 of SMO.	J13	Same as 1A.	0.8 to 3.0 volts ac.	
1C	Monitor the SMO frequency (300 kc above the frequency generator dial band 1 setting) with communications receiver.	SMO	ON-OFF switch to ON. TUNE-LOCAL-EXTERNAL CONTROL to LOCAL. Equipment conditioned to receive. Set frequency to 3.480 mc and set BAND CHANGE switch to BAND 1. Change frequency slowly with FREQUENCY CHANGE control.	Distinct 500-cps steps should be heard as frequency is changed.	If frequency change is garbled or sharp only when turned in one direction, test 2 should be performed.

TEST NO. 2. FREQUENCY CHECK

PRELIMINARY INSTRUCTIONS

Set ON-OFF switch to ON. Set TUNE-LOCAL-EXTERNAL CONTROL switch to LOCAL. Condition equipment for receive.

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	NORMAL INDICATION	REMARKS
2A	Connect a vtvm (ME-26A/U) for d-c operation of A2J2.	A2J2	Normal operation.	+0.4 to +0.6 volts dc.	If indication is not normal, proceed to step 4A.
2B	Connect a vtvm (ME-26A/U) for d-c operation at A7J2.	A7J2	Same as 2A.	Same as 2A.	Same as 2A.

TABLE 4-4. (Continued)

TEST NO. 2. FREQUENCY CHECK (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	NORMAL INDICATION	REMARKS
2C	Couple communications receiver to interpolation oscillator. Use antenna described in test 1, and lay coaxial cable near J8-F. Do not make metallic connection to printed circuit board. Calibrate receiver at 600 kc, and set to read 637.4 kc.	Interpolation oscillator	Set frequency generator frequency dial to 4.102 mc.	Interpolation frequency as monitored on receiver should be 637.0 to 637.5 kc.	If interpolation oscillator is not on frequency, adjust L2 through hole A of interpolation oscillator cover.
2D	Same as 2C with receiver set to 617.4 kc.	Same as 2C.	Set frequency generator frequency dial at 4.107 mc.	Interpolation oscillator frequency of 617.0 to 617.5 kc.	If interpolation oscillator is not on frequency, adjust L7 through hole B in interpolation oscillator cover.
2E	Same as 2C with receiver set to 597.4 kc.	Same as 2C.	Set frequency generator frequency dial to 4.112 mc.	Interpolation oscillator frequency of 597.0 to 597.5 kc.	If interpolation oscillator is not on frequency, adjust L12 through hole C of interpolation oscillator cover.
2F	Same as 2C with receiver set to 577.4 kc.	Same as 2C.	Set frequency generator frequency dial to 4.117 mc.	Interpolation oscillator frequency of 577.0 to 577.5 kc.	If interpolation oscillator is not on frequency, adjust L17 through hole D in interpolation oscillator cover.
2G	Same as 2C with receiver set to 557.4 kc.	Same as 2C.	Set frequency generator frequency to 4.122 mc.	Interpolation oscillator frequency of 557.0 to 557.5 kc.	If interpolation oscillator is not on frequency, adjust L22 through hole E of interpolation oscillator cover.

TABLE 4-4. (Continued)

<table>
<tr><th colspan="6">TEST NO. 2. FREQUENCY CHECK (Cont)</th></tr>
<tr><th>STEP</th><th>OPERATION OF TEST EQUIPMENT</th><th>POINT OF TEST</th><th>CONTROL SETTINGS AND OPERATION OF EQUIPMENT</th><th>NORMAL INDICATION</th><th>REMARKS</th></tr>
<tr><td>2H</td><td>Loosely couple communications receiver to SMO output (J13).</td><td>J13</td><td>Turn SMO through its frequency range (2 to 4 mc) by turning interpolation oscillator shaft. Observe AFC meter on front panel of frequency generator.</td><td>Average deflection each side of zero (center) scale should be equal. Distinct 500-cps steps should not read more than the following:
<table>
<tr><th>BAND FREQUENCY</th><th>MAXIMUM AFC</th></tr>
<tr><td>Up to 2.0 mc</td><td>90 ua</td></tr>
<tr><td>2.0 to 2.5 mc</td><td>80 ua</td></tr>
<tr><td>2.5 to 3.0 mc</td><td>70 ua</td></tr>
<tr><td>3.0 to 3.7 mc</td><td>50 ua</td></tr>
</table></td><td>Remove, SMO cover, loosen master oscillator shaft gear, and turn master oscillator shaft slightly in direction to bring AFC meter average deflection toward zero. Lock shaft and turn SMO shaft. If distinct 500-cps steps are not heard in both directions, loosen master oscillator shaft, and turn in direction to bring AFC meter reading toward zero. Repeat until distinct 500-cps steps are heard in both directions.</td></tr>
<tr><th colspan="6">TEST NO. 3. REFERENCE CHANNEL CHECK</th></tr>
<tr><td colspan="6">Set ON-OFF switch to ON. Set TUNE-LOCAL-EXTERNAL CONTROL switch to LOCAL. Condition equipment for receive.</td></tr>
<tr><td>3A</td><td>Connect vtvm (AN/USM-143) for a-c operation at A7J1, and check frequency by loosely coupling communications receiver to A7J1.</td><td>A7J1</td><td>Normal operating conditions.</td><td>1.5 to 10 mv ac at 455 kc (depending on interpolation oscillator frequency).</td><td>If normal, proceed to step 3B. If abnormal, proceed to step 3C.</td></tr>
<tr><td>3B</td><td>Same as 3A at P9-K. For stage gain check, inject 455-kc signal from r-f signal generator through 0.1-uf capacitor and 1K-ohm resistor in series to base of A7Q1, A7Q2, and A7Q3. (Cont)</td><td>P9-K</td><td>Same as 3A.</td><td>0.35 to 0.50 volt ac at 455 kc (depending on interpolation oscillator frequency).</td><td>If normal, proceed to test 6. If abnormal, check stage gain of reference i-f amplifier subassembly. The gain per stage of A7Q1 through A7Q3 should be 20 db.</td></tr>
</table>

TABLE 4-4. (Continued)

TEST NO. 3. REFERENCE CHANNEL CHECK (Cont)					
STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	NORMAL INDICATION	REMARKS
3B (Cont)	(Cont) Remove the 4-kc spectrum subassembly, A6, and use a 10,000-microvolt input at A7Q1.				
3C	Same as 3A at J8-F, but use Frequency Meter AN/USM-26 to check frequency.	J8-F	Same as 3A, but set CV-731/URC frequency dial to 3.506 mc.	0.8 to 1.5 volt a-c at 597 kc +400 cps, -0 cps. 1.0 to 2.0 volts a-c at 4 kc.	If normal, proceed to step 3D. If abnormal, check A5V1.
3D	Same as 3A at J8-A.	J8-A	Same as 3A.		If normal, proceed to step 3E. If abnormal, check frequency divider module.
3E	Check frequency at A6R15 with frequency counter or oscilloscope.	A6R15	Same as 3A.	4-kc spectrum 1.0 to 1.1 mc.	If normal, proceed to step 3F. If abnormal, check Q1, Q2, and Q3.
3F	Connect Electronic Voltmeter AN/USM-106 for a-c operation at pin 1 of A5V1.	Pin 1 of A6V1.	Same as 3A.	10 to 40 mv ac (1.0 to 1.1 mc).	If normal, proceed to step 3G. If abnormal, replace A6FL1.
3G	Repeat step 3A.	A7J1	Same as 3A.	1.5 to 10 mv ac at 455 kc.	If abnormal, check A6V1, check circuit, replace A7FL1 if necessary.
TEST NO. 4. SIGNAL CHANNEL CHECK					
PRELIMINARY INSTRUCTIONS					
Set ON-OFF switch to ON. Set TUNE-LOCAL-EXTERNAL CONTROL switch to LOCAL. Condition equipment for receive. Set frequency dial to 3.506 mc.					
4A	Connect vtvm (AN/USM-143) for a-c operation at J5-A, and check frequency by loosely coupling communications receiver to J5-A.	J5-A	Normal operating condition.	5 to 40 mv ac at 455 kc.	If normal, proceed to step 4I to check stage gain of signal i-f amplifier subassembly. If abnormal, proceed to step 4B.

TABLE 4-4. (Continued)

TEST NO. 4. SIGNAL CHANNEL CHECK (Cont)					
STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	NORMAL INDICATION	REMARKS
4B	Same as 4A at J5-L.	J5-L	Same as 4A.	15 to 60 mv ac at 8.452 mc.	If normal, proceed to step 4C. If abnormal, proceed to step 5F.
4C	Same as 4A at J5-J	J5-J	Same as 4A.	0.5 to 1.2 volts ac at 2.4 mc, +0, -3.0 kc.	If normal, proceed to step 4D. If abnormal, align sidestep oscillator module.
4D	Check frequency at A3V1, pin 5, with Communications Receiver R-390/URR.	Pin 5 of A3V1	Same as 4A.	Approximately 1952 kc.	If normal, proceed to step 4E. If abnormal, check A3V1.
4E	Connect vtvm (AN/USM-143) for a-c operation at pin 4 of A3V2.	Pin 4 of A3V2	Same as 4A.	20 to 100 mv ac at 1952 kc.	If normal, proceed to step 4F. If abnormal, replace A3FL1.
4F	Connect a vtvm (ME-26A/U) for a-c operation at J5-D.	J5-D	Same as 4A.	0.8 to 1.3 volts a-c.	If normal, proceed to step 4G. If abnormal, check A5V1 circuit.
4G	Check frequency at J5-D with communications receiver.	J5-D	Same as 4A.	597 kc +400 cps, -0 cps.	If normal, proceed to step 4H. If abnormal, align interpolation oscillator module (see steps 2C through 2G).
4H	Check frequency at pin 5 of A3V2 with communications receiver.	Pin 5 of A3V2	Same as 4A.	455 kc.	If abnormal, check A3V2.
4I	Connect a vtvm (ME-26A/U) for a-c operation at A1J1. Inject 455-kc signal from r-f signal generator through 0.1-uf capacitor and 1K-ohm resistor in series to base of A2Q6, A2Q5, A2Q4 and A2Q3. Use a 10,000 microvolt input at A2Q3.	A1J1	Set BAND CHANGE switch to BAND 3 ADD 1. Remove the sidestep oscillator module.	Over-all gain of 3.75 to 4 volts rms. (Model B and C SMO should have over-all gain of 8.0 to 10.0 volts rms.) Gain per stage is 20 db.	If normal, proceed to step 5A.

TABLE 4-4. (Continued)

TEST NO. 5. R-F SECTION CHECK

PRELIMINARY INSTRUCTIONS

Set ON-OFF switch to ON. Set TUNE-LOCAL-EXTERNAL CONTROL switch to LOCAL. Condition equipment for receive. Set frequency dial to 3.506 mc.

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	NORMAL INDICATION	REMARKS
5A	Connect a vtvm (ME-26A/U) for a-c operation at J13, and check frequency with Frequency Meter AN/USM-26.	J13	Normal operating condition.	1.3 to 3.0 volts ac at 3.806 mc ±1 kc.	If normal, proceed to step 5B. If abnormal, check master oscillator and Z1 tuning.
5B	Connect a vtvm (ME-26A/U) for d-c operation at J3.	J3	Same as 4A.	-3 to -8 volts dc. **Note** Bias may be -6 to -20 volts dc depending on date of manufacture.	If normal, proceed to step 5C. If abnormal, check doubler diodes and Z2 tuning.
5C	Connect a vtvm (ME-26A/U) for a-c operation at J12 and monitor frequency with Frequency Meter AN/USM-26.	J12	Same as 4A.	0.55 to 3.0 volts ac at 30.448 mc.	If normal, proceed to step 5D. If abnormal, check V1 and Z3 tuning.
5D	Connect a vtvm (ME-26A/U) for d-c operation at J2.	J2	Same as 4A.	-1 to 2.0 volts dc.	If normal, proceed to step 5E. If abnormal, check reference oscillator module, tube V3, and L3 tuning.
5E	Check frequency at pin 1 of V2 of r-f tuner subassembly with communications receiver.	Pin 1 of V2	Set SMO frequency to 3.306 mc by setting CV-731/URC frequency dial to 3.006 mc.	29.9 mc.	If normal, proceed to step 5F. If abnormal, check V4 and Z4 and Z5 for tuning.
5F	Check frequency at pin 5 of V2 with a communications receiver (R-390B/URR).	Pin 5 of V2	Normal operating conditions.	3.452 mc.	If normal, recheck step 4B. If 4B is abnormal, replace FL1. If abnormal, check V2.

TABLE 4-4. (Continued)

TEST NO. 6. MODEL B AND C FREQUENCY DISCRIMINATOR CHECK

PRELIMINARY INSTRUCTIONS

This test should be performed on equipment with model B or C SMO only. If equipment has a model A SMO, proceed to test no. 8. Set ON-OFF switch to ON. Set TUNE-LOCAL-EXTERNAL CONTROL switch to LOCAL. Condition equipment for receive.

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	NORMAL INDICATION	REMARKS
6A	Connect a vtvm (ME-26A/U) for d-c operation between pins E and J of J4 and ground.	Pins E and J of J4.	Set BAND CHANGE switch to BAND 3 ADD 1. Remove side-step oscillator module.	+16 volts d-c to ground at both points.	If normal, proceed to step 6B. If abnormal, replace master oscillator subassembly.
6B	Connect a vtvm (ME-26A/U) for d-c operation between pins E and J of J4. Connect ground lead of the meter to J4-E. Connect r-f signal generator (AN/URM-25F) to pin A of J4, and inject 455-kc, ±100 cps, 10-mv signal through 0.1-uf capacitor and 1K-ohm resistor in series.	Same as 6A.	Same as 6A.	0 to ±100 mv.	If normal, proceed to step 6C. If abnormal, align signal i-f amplifier subassembly.
6C	Same as 6B but change r-f signal generator frequency to 462.5 kc.	Same as 6A.	Same as 6A.	+8.0 volts d-c.	Same as 6B.
6D	Same as 6B but change r-f signal generator frequency to 447.5 kc.	Same as 6A.	Same as 6A.	-8.0 volts d-c.	Same as 6B.
6E	Connect Electronic Voltmeter AN/USM-106 for a-c operation at cathode of A2CR1. Connect r-f signal generator to pin A of J4, and inject a 455-kc ±100-cps, 10-millivolt signal through a 0.1-uf capacitor and a 1K-ohm resistor in series.	A2CR1	Same as 6A.	4 volts a-c.	If normal, check diode. If abnormal, check A2C26, C27, C32, and C33 and A2L1 and A2L2.

TABLE 4-4. (Continued)

<table>
<tr><th colspan="6">TEST NO. 6. MODEL B AND C FREQUENCY DISCRIMINATOR CHECK (Cont)</th></tr>
<tr><th>STEP</th><th>OPERATION OF TEST EQUIPMENT</th><th>POINT OF TEST</th><th>CONTROL SETTINGS AND OPERATION OF EQUIPMENT</th><th>NORMAL INDICATION</th><th>REMARKS</th></tr>
<tr><td>6F</td><td>Leave r-f signal generator connected as in 6E, and connect Electronic Voltmeter AN/USM-106 for a-c operation at cathode of A2CR2.</td><td>A2CR2</td><td>Same as 6A.</td><td>Same as 6E.</td><td>Same as 6E.</td></tr>
<tr><td>6G</td><td>Same as 6E with r-f signal generator set to 462.5 kc.</td><td>Same as 6E.</td><td>Same as 6A.</td><td>7 volts rms.</td><td>Same as 6E.</td></tr>
<tr><td>6H</td><td>Same as 6F with r-f signal generator set to 447.5 kc.</td><td>Same as 6F.</td><td>Same as 6A.</td><td>Same as 6G.</td><td>Same as 6E.</td></tr>
<tr><th colspan="6">TEST NO. 7. MODEL B AND C PHASE DISCRIMINATOR CHECK</th></tr>
<tr><td colspan="6">PRELIMINARY INSTRUCTIONS
This test should be performed on equipment with model B SMO or C only. If equipment has model A SMO, proceed to test no. 8. Set ON-OFF switch to ON. Set TUNE-LOCAL-EXTERNAL CONTROL switch to LOCAL. Condition equipment for receive.</td></tr>
<tr><td>7A</td><td>Connect a vtvm (ME-26A/U) for d-c operation between J4-J and J4-E with meter ground at J4-E.</td><td>J4-J and J4-E</td><td>Normal operating conditions.</td><td>The d-c output reference swings ±1.0 volt as A2T4 is adjusted each side of center. Adjust A2T4 for center position.</td><td>If normal, check components from R27 to J4 pin J. If abnormal, proceed to step 7B.</td></tr>
<tr><td>7B</td><td>Connect Electronic Voltmeter AN/USM-106 for a-c operation at input to A2CR5.</td><td>A2CR5</td><td>Same as 7A.</td><td>1.4 volts ac.</td><td>If normal, check A2CR5. If abnormal, check A2T4.</td></tr>
<tr><td>7C</td><td>Connect Electronic Voltmeter AN/USM-106 for a-c operation at input to A2CR5.</td><td>A2CR6</td><td>Same as 7A.</td><td>1.4 volts ac.</td><td>If normal, check A2CR6. If abnormal, check A2T4.</td></tr>
</table>

TABLE 4-4. (Continued)

TEST NO. 8. MODEL A FREQUENCY-LOCK CHECK

PRELIMINARY INSTRUCTIONS

This test should be performed on equipment with a model A SMO only. If equipment has a model B or model C SMO, perform test no. 6 instead. Set ON-OFF switch to ON. Set TUNE-LOCAL-EXTERNAL CONTROL switch to LOCAL. Condition equipment for receive.

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	NORMAL INDICATION	REMARKS
8A	Check frequency at J13 with Frequency Meter AN/USM-26.	J13	Turn SMO through its frequency range by turning FREQUENCY CHANGE control. The master oscillator frequency will be 300 kc above the dial reading.	Master oscillator error not more than ±1 kc from 2.0 to 4.0 mc.	If abnormal, align master oscillator shaft.
8B	Connect vtvm (AN/USM-143) for a-c operation at pin A of J4 to monitor tracking of Z4 and Z5.	J4-A	Same as 8A.	Z4 and Z5 tracked from 2.0 to 4.0 mc. Voltage remains nearly constant.	If tracking is abnormal, proceed to step 8C.
8C	Connect vtvm (AN/USM-143) from a-c operation at J4-A.	J4-A	Set frequency dial to 1.906 mc, and adjust slugs of Z4 and Z5 for maximum indication on 400D. Set frequency dial to 3.506 mc, and adjust capacitors of Z4 and Z5 for maximum indication on 400D. Repeat until tracking is nearly flat.	Z4 and Z5 tracked from 2.0 to 4.0 mc. Voltage remains nearly constant.	

TEST NO. 9. MODEL A PHASE-LOCK CHECK

PRELIMINARY INSTRUCTIONS

This test should be performed on equipment with model A SMO only. If equipment has model B or model C SMO, perform test no. 7 instead. Set ON-OFF switch to ON. Set TUNE-LOCAL-EXTERNAL CONTROL switch to LOCAL. Condition equipment for receive.

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	NORMAL INDICATION	REMARKS
9A	Remove power from SMO, remove shorting straps and install two 25-mc d-c meters at terminals E1-E2 and E3-E4. Observe proper polarity. E1 and E3 are positive.	E1-E4	Normal operating conditions.	Currents nearly balanced. Both currents above 4 ma.	If normal, proceed to step 9D. If abnormal, replace signal i-f amplifier subassembly. If no current is indicated, proceed to step 9B.

TABLE 4-4. (Continued)

TEST NO. 9. MODEL A PHASE-LOCK CHECK (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	NORMAL INDICATION	REMARKS
9B	Connect a vtvm (ME-26A/U) for a-c operation at A2J1.	A2J1	Same as 9A.	3.75 to 4.0 volts ac.	If normal, proceed to step 9C.
9C	Connect a vtvm (MD-26A/U) for d-c operation between E1 and ground and E3 and ground.	E1, E3	Same as 9A.	+28 volts at both points.	If +28 volts is not indicated, and step 9B was normal, A1Z1 in the master oscillator subassembly may be open.
9D	Monitor master oscillator frequency with Frequency Meter AN/USM-26 (at J13).	J13	Set SMO frequency to 645.2 kc by setting frequency dial to 3.700 mc. Monitor interpolation oscillator (IO) frequency at J8-F with frequency counter. With A2J2 grounded, adjust master oscillator frequency to 4.000 mc ±50 cps using A1L2, screw driven adjustment on shaft end of master oscillator (MO). Adjust interpolation oscillator frequency at position A to 4.000 mc ±50 cps. Remove the ground at A2J2 and ground A7J2, and note master oscillator error from 4.000 mc.	Master oscillator error should be ±25 cps. If not, adjust A2R3 with signal i-f amplifier subassembly, connect to SMO through extension board until the master oscillator with frequency lock is 4.000 mc ±25 cps. Remove ground from A7J2 and check that SMO phase locks to 4.000 mc.	If abnormal, adjust A2R3.

TABLE 4-5. TEST EQUIPMENT FOR FUNCTIONAL TESTING OF CV-731/URC

QTY	EQUIPMENT	MODEL	MFR	CHARACTERISTICS
1	Communications Receiver	R-390/URR	Collins	Frequency range: 0.5 to 32 mc Capability: receives CW, SSB, AM Tuning: continuous direct reading frequency on dial Calibration: crystal every 100 kc Selectivity: 100 cps to 16 kc in 6 steps
1	R-F Signal Generator	AN/URM-25F	Specialty Engineering and Electric	Frequency range: 10 kc to 50 mc Output voltage: 0.1 mv to 0.1 volt continuously variable (2.0 volts open circuit) Output impedance: 50 ohms
1	Electronic Voltmeter	AN/USM-143		Voltage range: 1.0 mv to 300 volts in 12 scales Frequency range: 10 cps to 4 mc Accuracy: ±5 percent Input impedance: 10 megohms
1	Electronic Voltmeter	ME-26A/U	Hewlett-Packard	Voltage range: 0 to 300 volts ac in 6 scales 0 to 1000 volts dc in 7 scales Frequency range: 20 cps to 700 mc Accuracy: ±3 percent A-c input impedance: 10 megohms D-c input impedance: 122 megohms Ohmmeter range: 10 ohms to 10 megohms in 7 ranges
1	Oscilloscope (Cont)	OS-46/U	DuMont	Vertical Channel (Y Axis) Deflection factor: Direct: 18 rms volts/inch ±17 percent Amplifier: Attenuator 1:1, Y amplitude maximum 10 rms millivolts/inch, Y amplitude minimum 115-190 rms millivolts/inch Frequency response: Direct: 10 percent response point at 100 kc, 50 percent response point at 300 kc

TABLE 4-5. (Continued)

QTY	EQUIPMENT	MODEL	MFR	CHARACTERISTICS
	Oscilloscope (Cont)			Amplifier: 10 percent response point at 100 kc, 50 percent response point at 300 kc Input impedance: Direct: 3 megohms, 20 uuf balanced; 1.5 megohms, 20 uuf unbalanced Amplifier: 2 megohms, 50 uuf Horizontal Channel (X Axis) Deflection factor: Direct: 21 rms volts/inch ±17 percent Amplifier: X attenuator 1:1, X amplitude maximum 0.5 rms volts/inch Frequency response: Direct: 10 percent response point at 100 kc; 50 percent response point at 300 kc Amplifier: 10 percent response point at 100 kc, 50 percent response at 300 kc Input impedance: Direct: 3 megohms, 20 uuf balanced; 1.5 megohms, 20 uuf unbalanced Amplifier: 2 megohms, 50 uuf
1	Frequency Meter	AN/USM-26	Hewlett-Packard	Frequency measurement: Range: 10 cps to 10 mc Gate times: 0.001, 0.01, 0.1, 1, 10 seconds or manually controlled Accuracy: ±1 count Period measurement: Reads in: seconds, milliseconds, microseconds Range: 0 cps to 10 kc Gate time: 1 or 10 cycles of unknown Accuracy: ±0.3 percent (one period); ±0.03 percent (ten period) Input impedance: 1 megohm shunted by 40 uuf

TABLE 4-5. (Continued)

QTY	EQUIPMENT	MODEL	MFR	CHARACTERISTICS
1	Electronic Voltmeter	AN/USM-106	Ballantine	Voltage range: 1 mv to 1000 volts with probe; 100 uv to 1 mv without probe Frequency range: 15 cps to 6 megacycles Accuracy: 15 cps to 3 megacycles ±3 percent 3 to 6 megacycles ±5 percent Input impedance: 11.1 megohms shunted by 7.5 uuf with probe; 1.11 megohms shunted by 25 uuf without probe Scales: logarithmic voltage scale reading 1-10; decibels scale reading 0-20
2	Multimeter	AN/PSM-4C	Jetronic Instruments	0.05 to 500 volts d-c in 10 steps 0.1 to 1000 volts ac in 9 steps 2 ua to 10 a dc in 9 steps 1 ohm to 100 megohms in 5 steps
1	Resistor			1K, 1/2 watt
1	Resistor			33 ohm, 1/2 watt
1	Resistor			47 ohm, 10 watt wire wound
1	Resistor			51 ohm, 1/2 watt
1	Resistor			150 ohm, 1/2 watt
1	Resistor			330 ohm, 1/2 watt

grid of the variable i-f amplifier stage, V2. The gain of V2 is controlled by EXCITER RF GAIN control on the sideband generator and by the tgc voltage (received from the tgc module of the sideband generator) preventing extreme overdriving of the power amplifier on peak signals. The amplified output of V2 is developed across the following interstage tuning circuits Z4, Z5, and Z6 and applied to band switch S2. The bands consist of the following frequencies:

Band 1	2.0 to 3.7 mc.
Band 2	3.7 to 7.7 mc.
Band 3	7.7 to 15.7 mc.
Band 4	15.7 to 30.0 mc.

Since the band 1 frequencies coincide with the variable i-f frequencies, no additional frequency conversion is necessary for band 1. Band 1 signals are bypassed around the transmitter high-frequency mixer, V3A, coupled through band switch S5 and capacitor C46, and applied to the control grid of the transmitter r-f amplifier, V4.

Since bands 2, 3, and 4 are higher frequencies than the variable i-f frequencies, additional frequency conversion of the variable i-f frequencies is necessary. When band 2 is selected, the variable i-f frequency signal is coupled through the band 2 position of band switch S2 and capacitor C26 and applied to the control grid of the transmitter high-frequency mixer, V3A. The 2.0- to 4.0-mc signal from T7 is coupled through band switch S12 and applied to the control grid, pin 1, of an amplifier stage, V10. The output from V10 is connected through band switch S14 and appears across Z28 in parallel with C177 and C178 which were inserted into the circuit by S14 for band 2 only. The signal from Z28 is coupled through band switch S15 and capacitor C174 and cathode injected into the transmitter high-frequency mixer, V3A. V3A is an additive mixer operating only during transmit operation. The injection of the variable i-f frequency of 1.7 to 3.7 mc and the 2.0- to 4.0-mc amplified SMO signal results in an output of 3.7 to 7.7 mc on band 2. This signal from V3A plate is developed across the band 2 interstage tuning circuits, Z7 and Z8, coupled through band switch S5 and capacitor C46, and impressed on the control grid of the transmitter r-f amplifier, V4.

When band 3 is selected, the variable i-f signal is applied to the transmitter high-frequency mixer, V3A. The 2.0- to 4.0-mc signal from the parallel-tuned circuit, consisting of C118, C119, C120, and the primary winding of T7, is coupled through capacitor C121 to the control grid of multiplier V9. The band 3 tuning circuit of Z26 and Z27 of V9 is tuned to three times the input frequency and causes the input to be tripled at the plate tank output. This 6.0- to 12.0-mc signal is coupled through band switch S12 and applied to the control grid, pin 1, of amplifier V10. The plate output of V10 is coupled through band switch S14, the band 3 tuned circuit of Z26, band switch S15, and capacitor C174 to the cathode of transmitter high-frequency mixer V3A. The mixing of the 1.7- to 3.7-mc variable i-f frequency and the 6.0- to 12.0-mc signal results in a 7.7- to 15.7-mc signal (band 3) which appears across the band 3 tuning circuits, Z9 and Z10, following V3A. This signal is coupled through band switch S5 and capacitor C46 and applied to the control grid of the transmitter r-f amplifier, V4.

When band 4 is selected, the variable i-f signal is mixed in the transmitter high-frequency mixer, V3A, with seventh harmonic of the 2.0- to 4.0-mc SMO signal. The multiplier, V9, with the band switches inserting the band 4 tuning circuit of Z26 and Z27 into the plate circuit, produces an output frequency band of 14.0 to 28.0 mc. This signal is amplified by amplifier V10 and cathode injected into the transmitter high-frequency mixer, V3A. The mixing action produces an output frequency band of 15.7 to 31.7 mc which is developed across the band 4 triple-tune circuits, Z11, Z12, and Z13. This signal is coupled through band switch S5 and capacitor C46 and applied to the control grid of the transmitter r-f amplifier, V4.

The output of V4 plate is developed across the selected interstage tuning circuits. The outputs for bands 1, 3, or 4 are taken from the capacitive voltage dividers of Z14, Z16, and Z17, respectively, and applied to band switch S8. From S8 the selected signal is coupled to band switch S9, through current-limiting resistor R13, and applied to the control grid of the transmitter output amplifier, V6. The V4 output for band 2 is connected from the capacitive voltage divider, C52 and C53 of Z15, to the control grid of an additional stage of r-f amplification, V5. V5 and the triple-tuned circuits immediately following are required for band 2 only. The function of the triple-tuned circuits provide additional selectivity for rejection of the second harmonic frequencies of the variable i-f amplifier stages and SMO signals which fall within the band 2 frequencies. V5 provides amplification to overcome the losses of the additional tuned circuits. The output of V5 is tuned by Z18, Z19, and Z20, coupled through band switch S9 and current-limiting resistor R13, and applied to the control grid of transmitter output amplifier V6. The output of V6 is taken from the plate pin 6 and developed across the tuned circuit provided for the selected band. The 0.2-watt (nominal) PEP signal is taken from a capacitive voltage divider of Z21, Z22, Z23, or Z24, depending on which is selected, coupled through band switch S11, and applied to receptacle P1-5 for delivery to the power amplifier.

Operation of band switches S1 and S16 controls the selection of the interstage parallel-tuned coupling circuits and is performed by band motor B1. B1 and the band switches geared to it are operated by a relay-drive type of band-switching circuit that initiates operation when the equipment is turned on. Control of the band-switching circuit depends on a ground being supplied on one of the four control lines, A, B, C, or D, when band selection is made with the BAND CHANGE switch on the front panel. The band-switching circuit is a ground-seeking type in which band motor B1 will operate, driving the switches geared to it, until the rotor tab of S16 is positioned to grounded control line. When this occurs, the grounded control line energizes the coil of band relay K1 and closes its contacts. The closing of K1 contacts removes the motor driving power from B1, causing it to stop, with the band switches in the selected band position.

The interstage, parallel-tuned circuits used in the r-f tuner module have a band pass of 16 kc, and each consists basically of a coil, a variable capacitor, and a fixed capacitor contained in separate plug-in subassemblies for ease of replacement when servicing. The variable capacitors permit individual tracking adjustment of the tuning circuits, while the variable coils permit simultaneous tuning of the interstage tuning circuits. The coils in this unit are of the permeability-tuned type in which the coil is tuned by positioning the core of the coil. The cores of all the interstage tuning circuit coils are mechanically connected to a rack which is raised or lowered through a gear arrangement by the FREQUENCY CHANGE control on the front panel. The coil cores attached to the rack are provided with adjustable screws to permit tracking adjustments.

The r-f tuner module normally is in receive condition and requires control to transfer it to transmit condition. This provision is accomplished by the use of three keying relays. The keying relay located on the sideband generator transfers the +130-volt d-c plate supply from the receive tubes to the transmit tubes, or the reverse. Keying relay K2 located in the r-f tuner module removes the received r-f signal from the receive tubes during transmit operation. K2 also provides a bias to the control grids of receive tubes preventing them from acting as coupling elements which would produce oscillations in the transmit tubes because of the common use of the interstage coupling and tuned circuits. The bias voltage of approximately -90 volts d-c is connected from P2-14 through contacts of keying relay K2 to the grid circuits of both receive mixers, the variable i-f amplifier, and the receiver r-f amplifier. A third keying relay located in the antenna coupler transfers the antenna from the receive circuits to the transmit circuits, or the reverse. All keying relays are actuated when a ground is placed on the key line.

(c) R-F TUNER MODULE, RECEIVE FUNCTION. - The r-f signal from receptacle P1-14 is connected through normally closed contacts of keying relay K2, through band switch section S7, and across selected tuning circuit Z14, Z15, Z16, or Z17 to the control grid of the receiver r-f amplifier, V8. The amplifier output of V8 is taken from the plate, coupled through band switch S5, and developed across the interstage tuning circuits. The signal then is coupled through S3 and capacitor C109 to the control grid of the receiver high-frequency mixer, V3B. Since the band 1 frequencies of 1.7 to 3.7 megacycles correspond to the variable i-f frequency band, no high-frequency conversion is necessary, and band 1 frequencies are bypassed around the receiver high-frequency mixer, V3B, through band switches S5 and S2. The signal taken from S2 is developed across the interstage tuning circuits, coupled through capacitor C13, and applied to the control grid of the receiver variable i-f amplifier, V7. Bands 2, 3, and 4 require frequency conversion down to the receiver variable i-f frequency range in the receiver high-frequency mixer, V3B. The same injection frequencies are used that were employed in the high-frequency mixer on the transmit operation of the r-f tuner module: 2.0 to 4.0 mc for band 2, 6.0 to 12.0 mc for band 3, and 14.0 to 28.0 mc for band 4. The difference frequency output band of the receiver high-frequency mixer is the same for bands 2, 3, and 4, this being the variable i-f frequency band of 1.7 to 3.7 mc. This signal is coupled through band switch S2, across the interstage tuning circuits for additional gain and selectivity, and through capacitor C13 to the control grid of the variable i-f amplifier, V7. The amplified output of V7 is developed across the interstage tuning circuits for additional gain and selectivity, coupled through C1, and applied to the control grid of the receiver low-frequency mixer, V1B. The 2.0- to 4.0-mc signal from the secondary winding of transformer T7 is cathode injected into V1B and beat with the variable i-f frequency band to produce a 300-kc i-f frequency containing the audio intelligence. The 300-kc plate output signal of V1B is coupled through variable output transformer T2 and applied to receptacle P1-11 of the r-f tuner module for delivery to the i-f amplifiers of the sideband generator. The receiver tubes of the r-f tuner module are provided with agc voltage from the sideband generator to assist in maintaining a nearly constant gain. The agc voltage is fed in through terminal 21 of receptacle P2 and applied to the control grids of receiver variable i-f amplifier and r-f amplifier tubes. In addition, these two stages have their gain controlled, along with that of the i-f amplifiers in the sideband generator, by a manually adjusted RECEIVER RF GAIN control on the sideband generator (AM-2064/URC). This control sets a bias voltage threshold on the agc bus. Tuning and band switching of the interstage tuning circuits is accomplished in the same manner as for the transmit operation of the r-f tuner module.

(d) STABILIZED MASTER OSCILLATOR MODULE. - There are three models of the stabilized master oscillator (SMO) used in Radio Set AN/URC-32( ): model A, model B, and model C, all of which are interchangeable. Model A and model B are used on earlier versions of the AN/URC-32. Model C is used on Radio Set AN/URC-32A and AN/URC-32B. Differences among models are discussed in the circuit description.

(e) STABILIZED MASTER OSCILLATOR, MODEL A AND MODEL B. - Refer to model A schematic diagram, figure 5-105, and model B schematic diagram, figure 5-106. The model B SMO is interchangeable with the model A SMO. Each SMO incorporates a different type of frequency control. The model B SMO replaces the saturable reactor with a silicon capacitor (Varicap) as the frequency-controlling component.

In conjunction with this frequency control change, the signal i-f discriminator board is changed to incorporate a compatible frequency discriminator. An AFC meter amplifier board is added in the stabilized master oscillator to accommodate the AFC meter to the discriminator circuit.

Note

> The changes made to the stabilized master oscillator are internal only. Therefore, the Varicap model (model B) as a complete module is electrically and mechanically interchangeable with the original stabilized master oscillator. However, the removable subassemblies that are changed are not interchangeable between the model B and the original stabilized master oscillator.

At the time of development of the original stabilized master oscillator, the most practical type of electronic frequency control was the saturable reactor. A saturable reactor, being driven by a current source, requires considerable power. However, the silicon capacitor, being a diode which exhibits a change in capacity as the voltage across it changes, is a high-impedance, voltage-driven device which requires little power. Consequently, the d-c amplifier used in the original design was eliminated. Separate phase and frequency discriminators are used. This permits separate phase and gain adjustments to achieve maximum frequency discriminator pull-in, maximum phase discriminator pull-in, and safe margin of gain to prevent loop instability.

(f) STABILIZED MASTER OSCILLATOR, MODEL C. - The model C stabilized master oscillator (SMO) is interchangeable with the original and model B stabilized master oscillators. Refer to figure 5-107 for model C schematic diagram. The model C stabilized master oscillator differs from the model B in that an LC network band-pass filter replaces the mechanical filter in the i-f mixer board circuitry. With the LC network band-pass filter of the model C stabilized master oscillator, the stabilizing loop pull-in range is increased from ±2 kc to approximately ±4 kc.

The following circuit descriptions apply to all three stabilized master oscillators.

(g) MASTER OSCILLATOR SUBASSEMBLY. - The master oscillator subassembly contains a modified Hartley oscillator and a buffer amplifier stage. The master oscillator furnished the injection frequencies for the frequency conversion circuits of the r-f tuner module. The operating frequency of the master oscillator, A1V2, is determined by the parallel-tuned circuit in its control grid circuit that can be mechanically and electronically tuned through the frequency range of 2.0 to 4.0 mc in the 125-cycle-per-second steps. A1V2 is a pentode in which the screen grid is used as the plate of the oscillator. The control grid tank circuit consists of several components of which A1L1 functions as the main tuning inductance and A1C8 as the main tuning capacitor. Inductor A1L1 is permeability tuned by means of a ten-turn tuning core that is geared mechanically to the FREQUENCY CHANGE control on the front panel. A1L1 also provides the inductive feedback to the cathode of A1V2 and A1Z1, also located in the tank circuit, and contains saturable reactor A1T1, capacitor A1C10, and coil A1L2 which is provided for tracking adjustments. A1T1 is used to permit positioning of the master oscillator to the additional one-quarter and one-eighth kilocycle increments necessary for output bands 3 and 4 and, in addition, is used to provide correction for master oscillator frequency drift. The plate output of A1V2 is a frequency in the range of 2.0 to 4.0 mc which is coupled through capacitor A1C1 and applied to the control grid of buffer amplifier A1V1. This stage amplifies the signal and isolates the master oscillator from load changes. The signal is taken from the plate of A1V1, coupled through receptacle A1P1 and coaxial cable, and applied to the r-f tuner subassembly.

The master oscillator subassembly of all SMO modules is provided with a heater element. Element HR1 maintains the subassembly above +25°C (+77°F). Thermal switch S1 removes the a-c power to HR1 when +25°C is attained. Another thermal switch, S2, prevents output of the master oscillator until its internal temperature reaches +20°C (+68°F). The heater element stabilizes components of the master oscillator and maintains the oscillator subassembly moisture free. The signal i-f amplifier subassembly of the model A SMO also contains a heater element. This heater element is wound around a compartment that contains the temperature-sensitive components of the phase and frequency discriminator. The temperature is maintained at +75°C (+167°F). Transistors A2Q1 and A2Q2 are matched for operation at this temperature.

(h) MASTER OSCILLATOR (MODEL B AND MODEL C SMO MODULES). - The master oscillator used in the model B and model C stabilized master oscillators uses Varicap frequency control. Refer to figure 5-106 or 5-107 for the schematic diagram. Capacitor A1C11, a voltage variable capacitor, located in the tank circuit positions the master oscillator to the additional 10.125- and 0.250-kc increments necessary for output on bands 3 and 4 respectively, and, in addition, is used to provide correction for master oscillator frequency shift. Operation of A1C11 is deferred until discussion of the phase and frequency discriminator circuits of the i-f signal amplifier subassembly. Inductor A1L2 in the tank circuit is for tuning adjustment.

(i) R-F TUNER SUBASSEMBLY. - In the r-f tuner subassembly of the SMO, the signal is impressed across a parallel-tuned circuit Z1 which acts both as a coupling circuit for the SMO output and a tank circuit for buffer amplifier A1V1. Z1 consists of transformer T1 and capacitors C3 and C4. Variable capacitor C3 permits tracking adjustments of the tuned circuit. The secondary winding of T1 couples the SMO output signal to receptacle P1 for external use and appears as a 50-ohm source to the r-f tuner. The signal developed across the tuned circuit is supplied as a driving source to a multiplier stage. The first frequency multiplication occurs in a bridge circuit consisting of four diodes, CR1, CR2, CR3, and CR4. The bridge is connected as a full-wave rectifier which provides an output ripple frequency of twice the input signal frequency. Therefore, the output of the bridge circuit is in the 4.0- to

8.0-mc frequency band which appears across Z2. Z2 contains a coupling transformer T2 which has its secondary winding used as the coil of a parallel-tuned circuit in which capacitors C7 and C8 are the paralleling capacitors. Variable capacitor C7 is provided for tracking adjustments. The signal appearing across Z2 is direct coupled to the control grid of second multiplier stage, V1. V1 is heavily overdriven to produce harmonics and has its plate output developed across parallel-tuned circuit Z3, which consists of variable coil L2 and capacitors C11 and C12. Variable capacitor C12 permits tracking adjustment of the Z3 operating frequency. The output signal appearing across Z3 is 16.0 to 32.0 mc which is coupled through C14 and applied to the control grid of the first mixer, V2.

The 100-kc signal from the reference oscillator module is coupled into the SMO through terminal 11 of receptacle P1. From P1-11, the signal is coupled through isolation resistor R3 and applied to a tap of the 100-kc tuned circuit, consisting of L3 and C20. On the positive half-cycle of the input signal, CR7 does not conduct, and C40 charges to approximately +12 volts. V3 is operated with zero bias on the control grid and reaches plate saturation during the positive half-cycle of the input signal. During the negative half-cycle, the input signal must provide the +12 volt bias on the cathode of CR7 before the diode will conduct. When CR7 does conduct, C40 discharges through R31, and V3 is driven to cutoff for about one third of the negative half-cycle of the input signal. This type of operation produces a distorted square wave which is coupled through C24 and applied to the control grid of a dual-triode spectrum generator, V4. Diode CR5 clamps the control grid to ground for any negative component in the input square wave. CR6 is a limiter which also squares up the leading edge of the distorted square wave and ensures that each succeeding pulse starts at exactly the same point of phase relation as the preceding pulse. The spectrum generator, V4, connected in a modified cathode-coupled multivibrator circuit, generates a spectrum of 100-kc increments. The section of V4 consisting of leads 2, 3, and 4, normally is in nonconducting condition and does not operate until the arrival of the square-wave pulse on the control grid, lead 3. The section of V4 consisting of pins 6, 7, and 8, normally is conducting. The arrival of a pulse on the control grid, lead 3, triggers the left half of V4 into conduction where it remains as long as the positive pulse is present and causes the right half to cut off. When the pulse has passed, the left half of V4 returns to nonconducting condition, and the right half returns to conducting condition. The arrival of each 100-kc square-wave pulse will cause a recurrence of the above sequence. This circuit is prevented from being a free-running multibrator by the use of a common bias resistor R18 and capacitor C26 in the cathode circuit of V4. The current flowing through R18 and the right half of V4, when no pulse is present on the control grid of the first section, creates a +8-volt bias on the cathode of diode CR6. The signal impressed on the control grid, lead 3, on the left section of V4 must overcome this bias before the left half will conduct. The feedback path for the multivibrator is through C27 for the plate circuit and through C25 for the cathode circuit. When the left-hand section of V4 conducts, it pulses tuned circuits Z4 and Z5 to oscillate at their resonant frequency, keyed at a 100-kc rate. Parallel-tuned circuits Z4 and Z5 may be tuned to frequencies in the band of 19.5 to 35.5 mc. The 100-kc spectrum frequencies at which the tuned circuits resonate is selected when the FREQUENCY CHANGE control is operated, since all tuned circuits in the CV-731/URC are ganged mechanically. The selected 100-kc spectrum points of the 19.5- to 35.5-mc band are delivered to first mixer V2 as an injection signal to the control grid. Tuned circuits Z4 and Z5 are positioned mechanically to operate at a 100-kc spectrum point frequency which will beat with the multiplied master oscillator signal present on the control grid to produce a difference signal within the 3.37- to 3.53-mc pass band of filter FL1.

(j) I-F MIXERS SUBASSEMBLY. - Two types of i-f mixers subassemblies are used. The i-f mixer subassembly used with the model A and model B stabilized master oscillator module has a mechanical filter (A3FL2). In the i-f mixers subassembly used with the model C SMO, A3FL2 is an LC filter. The value of some of the components of the two types is somewhat different also, but basically the difference is in the filter. The LC filter has a 60-kc nose and the mechanical filter has a 40-kc nose. The output taken from FL1 of the r-f tuner subassembly is fed into the i-f mixers subassembly and applied to the control grid (pin 1) of second mixer A3V1. A mixing signal from the sidestep oscillator module or the reference oscillator module (2.4, 2.399, 2.398, or 2.397 mc) is introduced through tuned transformer A3T1 and applied to the suppressor grid (pin 4) of A3V1. The output is passed through a 970- to 1130-kc pass-band filter, A3FL1, to obtain the difference frequency. The output of the filter is applied to the suppressor grid (pin 4) of third mixer A3V2 where it mixes with the 549- to 645-kc interpolation oscillator (IO) output signal to generate the 455-kc difference frequency selected by filter A3FL2. Filter A3FL2 has a 40- or 60-kc band-pass characteristic which passes the multiplied positioning or correction error. Mechanical filter A3FL2 (used in model A SMO and model B SMO) has its input tuned by A3C5 and its output tuned by A3C8-A3C9, which also function as a capacitive voltage divider for the output signal and match the input impedance of the following transistor stage A2Q6, of the signal i-f amplifiers subassembly. The LC filter (used in model C SMO) is not tuned externally. The i-f signal output of the i-f mixers subassembly is taken through terminal A of receptacle A3P1, coupled through coaxial cable, and applied through terminal B of receptacle A2P1 at the signal i-f amplifier subassembly.

(k) INTERPOLATION OSCILLATOR SUBASSEMBLY. - The interpolation oscillator subassembly provides twenty-five 4-kc steps in the frequency band of 549.4 to 645.4 kc. The interpolation oscillator, A5V1, is a pentode in an inductance-tuned

NOTES
1-HEAVY LINES INDICATE MAIN SIGNAL PATHS, LIGHT LINES INDICATE AUXILIARY OR SECONDARY SIGNAL PATHS, AND LIGHT BROKEN LINES INDICATE MECHANICAL LINKAGE
2-LETTERS AND NUMBERS OUTSIDE CIRCUIT BLOCKS INDICATE ELEMENT AND PIN NUMBERS. NUMBERS ON BLOCKS OTHER THAN CIRCUIT BLOCKS INDICATE TERMINAL NUMBERS
3-RELAYS ARE SHOWN IN DE-ENERGIZED POSITION.

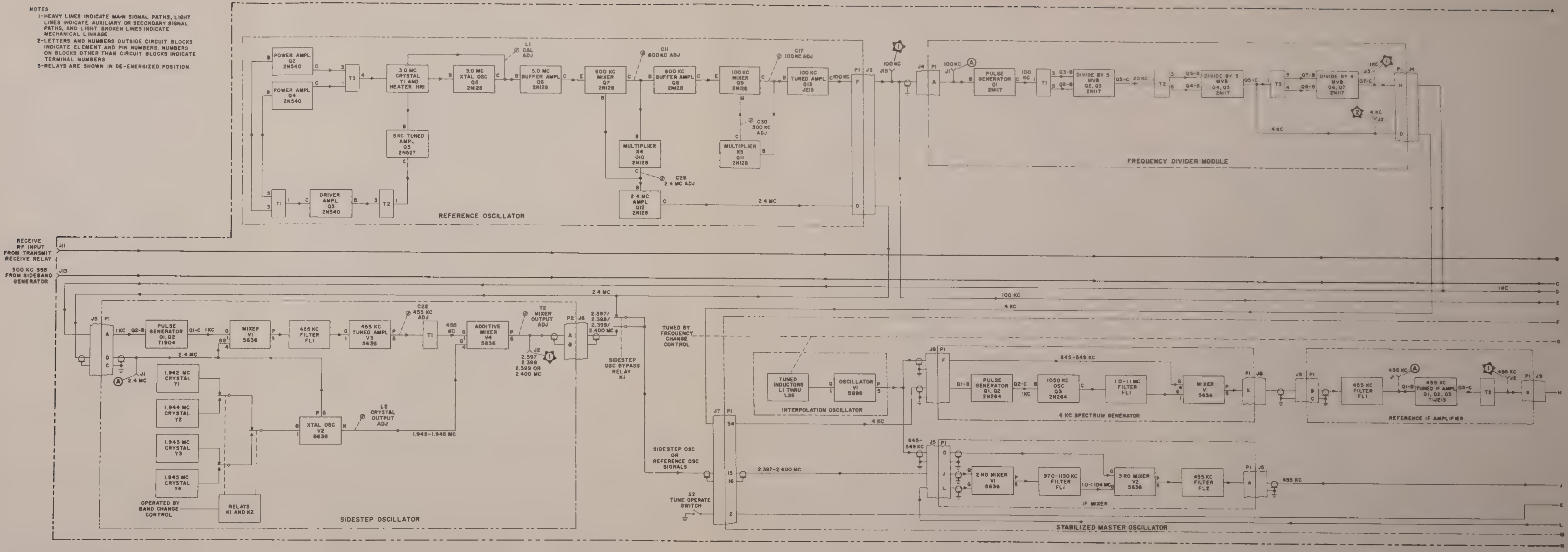
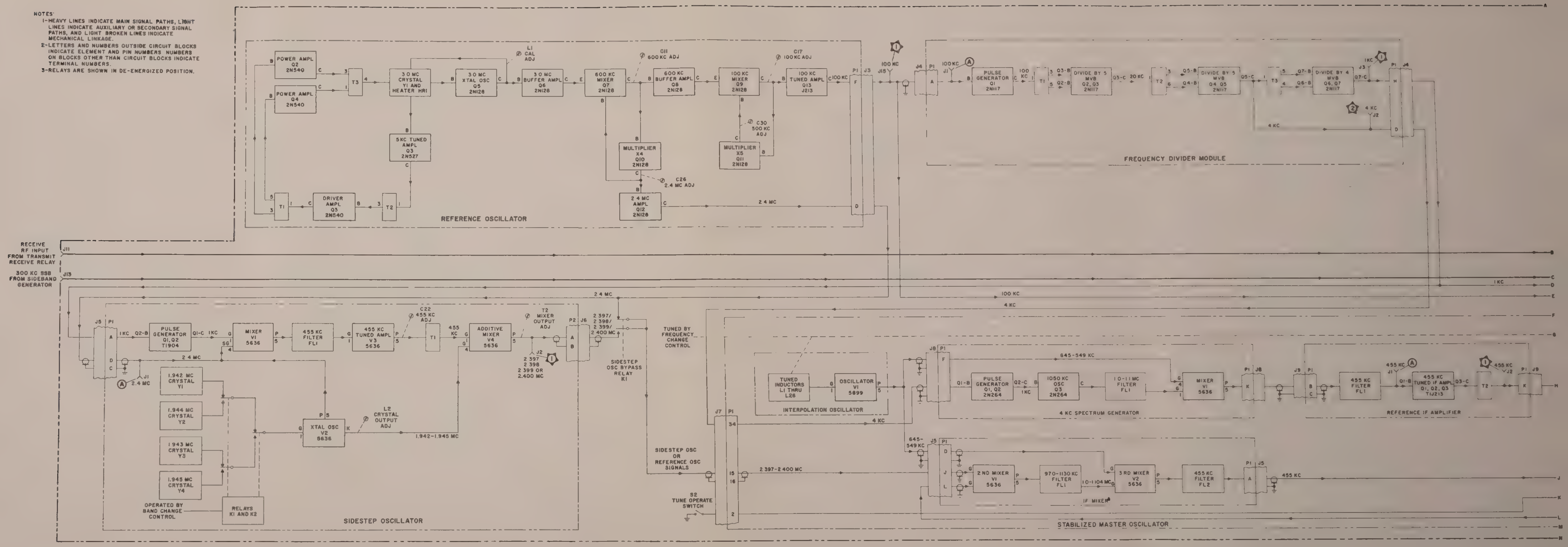

POWER AMPL Q2 2N540
POWER AMPL Q4 2N540
T3
3.0 MC CRYSTAL Y1 AND HEATER HR1
3.0 MC XTAL OSC Q5 2N128
L1 CAL ADJ
3.0 MC BUFFER AMPL Q6 2N128
600 KC MIXER Q7 2N128
C11 600 KC ADJ
600 KC BUFFER AMPL Q8 2N128
100 KC MIXER Q9 2N128
C17 100 KC ADJ
100 KC TUNED AMPL Q13 J213
5 KC TUNED AMPL Q3 2N527
MULTIPLIER X4 Q10 2N128
MULTIPLIER X5 Q11 2N128
C30 500 KC ADJ
C26 2.4 MC ADJ
2.4 MC AMPL Q12 2N128
2.4 MC
T1
DRIVER AMPL Q3 2N540
T2
REFERENCE OSCILLATOR
P1 J3
100 KC J15
J4 P1
100 KC J1
PULSE GENERATOR Q1 2N117
100 KC
DIVIDE BY 5 MVB Q2, Q3 2N117
Q3-C 20 KC
DIVIDE BY 5 MVB Q4, Q5 2N117
DIVIDE BY 4 MVB Q6, Q7 2N117
1 KC J3
4 KC J2
4 KC
FREQUENCY DIVIDER MODULE
RECEIVE RF INPUT FROM TRANSMIT RECEIVE RELAY
J11
300 KC SSB FROM SIDEBAND GENERATOR
J13
2.4 MC
100 KC
4 KC
1 KC
J5 P1
1 KC
PULSE GENERATOR Q1, Q2 T1904
MIXER V1 5636
455 KC FILTER FL1
455 KC TUNED AMPL V3 5636
C22 455 KC ADJ
455 KC
ADDITIVE MIXER V4 5636
T2 MIXER OUTPUT ADJ
P2 J6
2.397/ 2.398/ 2.399/ 2.400 MC
2.397 2.398 2.399 OR 2.400 MC
J2
J1 2.4 MC
1.942 MC CRYSTAL Y1
1.944 MC CRYSTAL Y2
1.943 MC CRYSTAL Y3
1.945 MC CRYSTAL Y4
XTAL OSC V2 5636
L2 CRYSTAL OUTPUT ADJ
1.942–1.945 MC
OPERATED BY BAND CHANGE CONTROL
RELAYS K1 AND K2
SIDESTEP OSCILLATOR
SIDESTEP OSC BYPASS RELAY K1
TUNED BY FREQUENCY CHANGE CONTROL
TUNED INDUCTORS L1 THRU L26
OSCILLATOR V1 5899
INTERPOLATION OSCILLATOR
J8 P1
645–549 KC
PULSE GENERATOR Q1, Q2 2N264
1 KC
1050 KC OSC Q3 2N264
1.0-1.1 MC FILTER FL1
MIXER V1 5636
4 KC SPECTRUM GENERATOR
J7 P1
4 KC
SIDESTEP OSC OR REFERENCE OSC SIGNALS
2.397–2.400 MC
S2 TUNE OPERATE SWITCH
645–549 KC
J5 P1
2 ND MIXER V1 5636
970–1130 KC FILTER FL1
1.0-1.104 MC
3 RD MIXER V2 5636
455 KC FILTER FL2
IF MIXER
455 KC
STABILIZED MASTER OSCILLATOR
J9 P1
455 KC FILTER FL1
455 KC J1
455 KC TUNED IF AMPL Q1, Q2, Q3 T1J213
T2
455 KC J2
REFERENCE IF AMPLIFIER
A
B
C
D
E
F
G
H
J
K
L
M
N

Figure 4-11. Converter-Oscillator CV-731/URC, Servicing Block Diagram (Sheet 1 of 2)


POWER AMPL Q2 2N540
POWER AMPL Q4 2N540
T3
3.0 MC CRYSTAL Y1 AND HEATER HR1
3.0 MC XTAL OSC Q5 2N128
L1 CAL ADJ
3.0 MC BUFFER AMPL Q6 2N128
600 KC MIXER Q7 2N128
C11 600 KC ADJ
600 KC BUFFER AMPL Q8 2N128
100 KC MIXER Q9 2N128
C17 100 KC ADJ
100 KC TUNED AMPL Q13 J213
100 KC
5 KC TUNED AMPL Q3 2N527
MULTIPLIER X4 Q10 2N128
C26 2.4 MC ADJ
C30 500 KC ADJ
MULTIPLIER X5 Q11 2N128
2.4 MC AMPL Q12 2N128
2.4 MC
T1
DRIVER AMPL Q3 2N540
T2
REFERENCE OSCILLATOR
P1 J3
100 KC J15
J4 P1
100 KC J1
PULSE GENERATOR Q1 2N117
100 KC
T1
DIVIDE BY 5 MVB Q2, Q3 2N117
20 KC
T2
DIVIDE BY 5 MVB Q4 Q5 2N117
T3
DIVIDE BY 4 MVB Q6, Q7 2N117
1 KC J3
4 KC J2
4 KC
P1 J4
FREQUENCY DIVIDER MODULE
RECEIVE RF INPUT FROM TRANSMIT RECEIVE RELAY
J11
300 KC SSB FROM SIDEBAND GENERATOR
J13
2.4 MC
100 KC
4 KC
1 KC
J5 P1
PULSE GENERATOR Q1, Q2 T1904
MIXER V1 5636
455 KC FILTER FL1
455 KC TUNED AMPL V3 5636
C22 455 KC ADJ
T1
455 KC
ADDITIVE MIXER V4 5636
T2 MIXER OUTPUT ADJ
J2 2.397 2.398 2.399 OR 2.400 MC
P2 J6
2.397/ 2.398/ 2.399/ 2.400 MC
J1 2.4 MC
1.942 MC CRYSTAL Y1
1.944 MC CRYSTAL Y2
1.943 MC CRYSTAL Y3
1.945 MC CRYSTAL Y4
XTAL OSC V2 5636
L2 CRYSTAL OUTPUT ADJ
1.942–1.945 MC
OPERATED BY BAND CHANGE CONTROL
RELAYS K1 AND K2
SIDESTEP OSCILLATOR
TUNED BY FREQUENCY CHANGE CONTROL
SIDESTEP OSC BYPASS RELAY K1
SIDESTEP OSC OR REFERENCE OSC SIGNALS
S2 TUNE OPERATE SWITCH
J7 P1
2.397–2.400 MC
TUNED INDUCTORS L1 THRU L26
OSCILLATOR V1 5899
INTERPOLATION OSCILLATOR
4 KC
J8 P1
645–549 KC
PULSE GENERATOR Q1, Q2 2N264
1 KC
1050 KC OSC Q3 2N264
1.0–1.1 MC FILTER FL1
MIXER V1 5636
4 KC SPECTRUM GENERATOR
P1 J8
J9 P1
455 KC FILTER FL1
455 KC J1
455 KC TUNED IF AMPL Q1, Q2, Q3 TIJ213
T2
455 KC J2
P1 J9
REFERENCE IF AMPLIFIER
645–549 KC
J5 P1
2ND MIXER V1 5636
970–1130 KC FILTER FL1
1.0–1.104 MC
3RD MIXER V2 5636
455 KC FILTER FL2
P1 J5
455 KC
IF MIXER
STABILIZED MASTER OSCILLATOR
A
B
C
D
E
F
G
H
J
K
L
M
N

NOTES:

1-HEAVY LINES INDICATE MAIN SIGNAL PATHS, LIGHT LINES INDICATE AUXILIARY OR SECONDARY SIGNAL PATHS, AND LIGHT BROKEN LINES INDICATE MECHANICAL LINKAGE.

2-LETTERS AND NUMBERS OUTSIDE CIRCUIT BLOCKS INDICATE ELEMENT AND PIN NUMBERS. NUMBERS ON BLOCKS OTHER THAN CIRCUIT BLOCKS INDICATE TERMINAL NUMBERS.

3-RELAYS ARE SHOWN IN DE-ENERGIZED POSITION.

Figure 4-11. Converter-Oscillator CV-731/URC,
Servicing Block Diagram (Sheet 1 of 2)

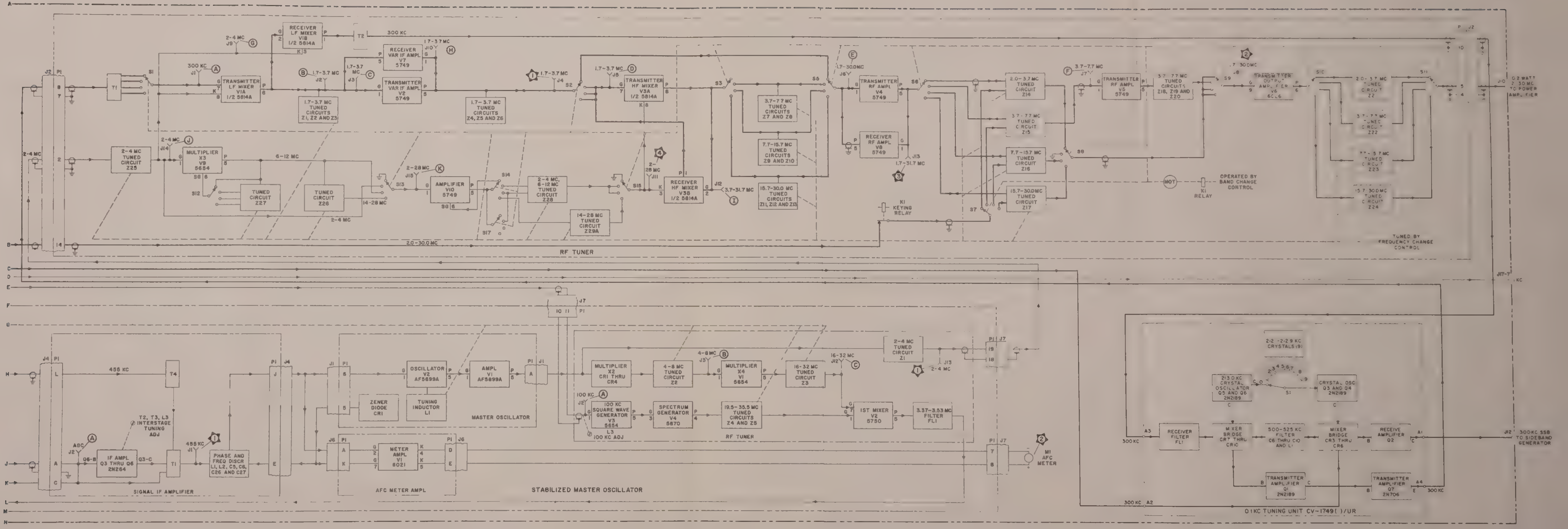

A
B
C
D
E
F
G
H
J
K
L
M
N
J2
P1
RECEIVER LF MIXER V1B 1/2 5814A
300 KC
T2
2-4 MC J9 G
1.7-3.7 MC J10 H
RECEIVER VAR IF AMPL V7 5749
300 KC J1 A
S1
T1
TRANSMITTER LF MIXER V1A 1/2 5814A
B 1.7-3.7 MC J2
1.7-3.7 MC J3 C
TRANSMITTER VAR IF AMPL V2 5749
1.7-3.7 MC TUNED CIRCUITS Z1, Z2 AND Z3
1.7-3.7 MC TUNED CIRCUITS Z4, Z5 AND Z6
1 1.7-3.7 MC J4
S2
1.7-3.7 MC J8 D
TRANSMITTER HF MIXER V3A 1/2 5814A
S3
S5
3.7-7.7 MC TUNED CIRCUITS Z7 AND Z8
7.7-15.7 MC TUNED CIRCUITS Z9 AND Z10
15.7-30.0 MC TUNED CIRCUITS Z11, Z12 AND Z13
E 1.7-30.0MC J6
TRANSMITTER RF AMPL V4 5749
RECEIVER RF AMPL V8 5749
J13 1.7-31.7 MC
3
S6
F 3.7-7.7 MC J7
2.0-3.7 MC TUNED CIRCUIT Z14
3.7-7.7 MC TUNED CIRCUIT Z15
7.7-15.7 MC TUNED CIRCUIT Z16
15.7-30.0MC TUNED CIRCUIT Z17
S7
S8
TRANSMITTER RF AMPL V5 5749
3.7-7.7 MC TUNED CIRCUITS Z18, Z19 AND Z20
2
.7 30.0MC J8
S9
TRANSMITTER OUTPUT AMPLIFIER V6 6CL6
S10
S11
2.0-3.7 MC TUNED CIRCUIT Z22
3.7-7.7 MC TUNED CIRCUIT Z22
7.7-15.7 MC TUNED CIRCUIT Z23
15.7-30.0MC TUNED CIRCUIT Z24
P J2
J10 0.2 WATT 2-30MC TO POWER AMPLIFIER
MOT
K1 RELAY
OPERATED BY BAND CHANGE CONTROL
TUNED BY FREQUENCY CHANGE CONTROL
2-4 MC
2-4 MC TUNED CIRCUIT Z25
2-4 MC J14 J
MULTIPLIER X3 V9 5654
6-12 MC
S12
TUNED CIRCUIT Z27
TUNED CIRCUIT Z26
14-28 MC
2-4 MC
S13
2-28 MC J15 K
AMPLIFIER V10 5749
S14
2-4 MC, 6-12 MC TUNED CIRCUIT Z28
14-28 MC TUNED CIRCUIT Z29A
S17
4
2-28 MC J11
S15
RECEIVER HF MIXER V3B 1/2 5814A
J12 3.7-31.7 MC I
K1 KEYING RELAY
2.0-30.0 MC
RF TUNER
J17-7 KC
J4 P1
455 KC
T4
T2, T3, L3 INTERSTAGE TUNING ADJ
AGC J2 A
IF AMPL Q3 THRU Q6 2N264
Q6-B
Q3-C
T1
455 KC J1 1
PHASE AND FREQ DISCR L1, L2, C5, C6, C26 AND C27
SIGNAL IF AMPLIFIER
OSCILLATOR V2 AF5899A
AMPL V1 AF5899A
ZENER DIODE CR1
TUNING INDUCTOR L1
MASTER OSCILLATOR
METER AMPL V1 6021
AFC METER AMPL
STABILIZED MASTER OSCILLATOR
J7
P1
MULTIPLIER X2 CR1 THRU CR4
4-8 MC TUNED CIRCUIT Z2
4-8 MC J3 B
MULTIPLIER X4 V1 5654
16-32 MC J12 C
16-32 MC TUNED CIRCUIT Z3
2-4 MC TUNED CIRCUIT Z1
1 J13 2-4 MC
100 KC J2 A
100 KC SQUARE WAVE GENERATOR V3 5654
L3 100 KC ADJ
SPECTRUM GENERATOR V4 5670
19.5-35.5 MC TUNED CIRCUITS Z4 AND Z5
1ST MIXER V2 5750
3.37-3.53 MC FILTER FL1
RF TUNER
2
M1 AFC METER
212-212.9 KC CRYSTALS (9)
213.0 KC CRYSTAL OSCILLATOR Q5 AND Q6 2N2189
S1
CRYSTAL OSC Q3 AND Q4 2N2189
300 KC A3
RECEIVER FILTER FL1
MIXER BRIDGE CR7 THRU CR10
500-525 KC FILTER C6 THRU C10 AND L1
MIXER BRIDGE CR3 THRU CR6
RECEIVE AMPLIFIER Q2
A1
J12 300KC SSB TO SIDEBAND GENERATOR
TRANSMITTER AMPLIFIER Q1 2N2189
TRANSMITTER AMPLIFIER Q7 2N706
A4 300 KC
300 KC A2
0.1KC TUNING UNIT CV-1749( )/UR

Figure 4-11. Converter-Oscillator CV-731/URC, Servicing Block Diagram (Sheet 2 of 2)

Hartley oscillator circuit. The tuned circuit inductance is varied by switching in additional coils in series for a total of 25 frequency steps. The frequency of the oscillator changes 4 kc for each additional series coil that is switched into the circuit. The interpolation oscillator subassembly tuning is geared mechanically to all the other tuned circuits of the frequency generator. The output signal of the interpolation oscillator is coupled through capacitor A5C7 and supplied as two outputs. One output is coupled through resistor A5R7, fed through coaxial cable, and applied to the suppressor grid of the third mixer, A3V2. The second output is applied to the fourth mixer stage in the 4-kc spectrum generator board.

(l) SIGNAL I-F AMPLIFIER SUBASSEMBLY FOR STABILIZED MASTER OSCILLATOR, MODEL A. - In the signal i-f amplifier subassembly, the signal is amplified by four grounded emitter transistor stages in cascade. The i-f signal is applied to the first i-f amplifier, A2Q6, whose output is applied to coupling transformer A2T3. Resistor A2R15 decreases the circuit Q to decrease the bandwidth. The i-f signal taken from the secondary winding of A2T3 is applied to the base of the second i-f amplifier, A2Q5, whose collector output is developed across a parallel-tuned circuit consisting of the primary winding of i-f coupling transformer A2T2 and capacitor A2C16. This circuit also is provided with a parallel resistor, A2R12, to increase the bandwidth. A2T2 also is a step-down transformer to match impedance between the collector of A2Q5 and the base of A2Q4. The i-f signal is taken from the secondary winding of A2T2 and impressed on the base of the third i-f amplifier, A2Q4, whose collector output is developed across a parallel-tuned circuit consisting of autotransformer A2L3, capacitor A2C13, and broadbanding resistor A2R8. The signal applied to the base of the fourth i-f amplifier, A2Q3, is taken from a low-impedance tap of A2L3. The collector output of A2Q3 is developed across a parallel-tuned circuit consisting of the primary winding of A2T1 and capacitor A2C9. The d-c feedback is taken from the emitter of A2Q3, coupled through A2R9, and applied to the base circuit of A2Q4 to assist in stabilizing these transistor stages. A2C10 prevents any a-c feedback by coupling any a-c to ground.

The signal taken from the secondary winding of A2T1 is used to derive automatic gain control (agc) voltage for the i-f amplifier stages. Diode A2CR3 rectifies the i-f signal delivered to it, with the resulting voltage appearing across a timing circuit consisting of capacitors A2C11 and A2C25 and bleeder resistors A2R6 and A2R7. The output of this circuit is applied to the base circuits of the first and second i-f amplifiers, A2Q5, to accomplish agc action. Resistors A2R18 and A2R19 form a bleeder from the +28-volt d-c supply and function as a clamping circuit for the agc line to maintain a positive voltage on the line that determines the conduction level for A2CR4. Capacitor A2C12 is an r-f bypass. The signal i-f is taken from the collector of the last i-f amplifier, A2Q3, coupled through capacitor A2C7, and applied to junction of two parallel-tuned circuits that are a portion of the phase and frequency discriminator. The characteristics of this discriminator permit it to perform both phase and frequency discriminating action in a single circuit.

Frequency discriminating action of the discriminator occurs in the following manner. The two parallel-tuned circuits, consisting of A2L1-A2C5-A2C26 and A2L2-A2C6-A2C27, are tuned to resonate at frequencies above and below the no-error, 455-kc, i-f signal respectively. The i-f signal is fed in parallel to the two circuits. These circuits must perform two functions by providing nearly constant impedance-matching between the last signal i-f amplifier, A2Q3, and the discriminator circuit, and discriminating action to assist master oscillator frequency correction. To accomplish these two functions, a complementary filter arrangement is used. The filter arrangement also provides a desirable discriminator response curve by preventing the outer frequency skirts from falling off sharply.

Figure 4-12 illustrates the derivation of the complementary filter circuits. Refer to figure 4-12A. Shown in this figure are conventional low- and high-pass filters FL1 and FL2. Immediately below are shown typical response curves for these circuits. A reciprocal law permits these two circuits to have their inputs fed in parallel which causes them to appear as shown in figure 4-12B. This type of connection provides a complementary arrangement in which each filter section furnishes the necessary shunt element for the opposite section. In this manner, the shunt elements shown in figure 4-12A are unnecessary and may be removed. Immediately below the filter circuit in figure 4-12B, typical response curves of the complementary filters are shown on the same plot. Due to back-to-back arrangement of the filters, it is permissible to flip the response of FL1 as shown. The resultant response curve is that of the frequency discriminator. Figure 4-12C shows the addition of CX and LX in parallel with FL1 and FL2 respectively. These components provide tuning of the filters to cause the slope of the composite characteristic to be steeper about the 455-kc crossover frequency which increases discriminator sensitivity.

Refer to figure 4-13. Introduction of a 455-kc signal through A2C7 causes equal conduction in each half of the discriminator during the positive alternation. The resulting currents are rectified by diodes A2CR1 and A2CR2 and flow through the base-to-emitter circuits of A2Q1 and A2Q2 respectively. The rectified signal causes the bases of A2Q1 and A2Q2 to be driven to some positive value which produces collector output from both. The d-c currents are passed through the center-tapped d-c control winding of saturable reactor A1T1 in a 180-degree relation that causes them to oppose. This causes cancellation of the core flux produced by each in A1T1. In this condition, the discriminator is balanced, and the net control exerted on A1T1 is zero. Figure 4-14 illustrates a representative curve of A1T1 d-c control winding current versus change in master oscillator frequency, where point A indicates

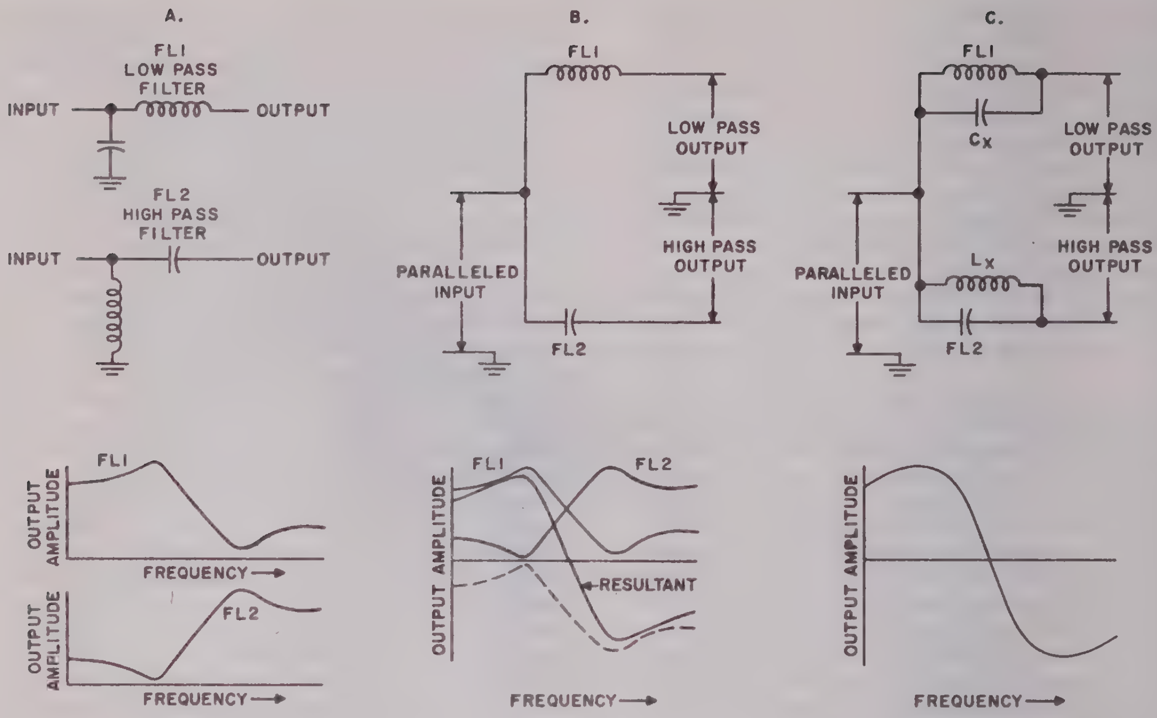

A.
FL1
LOW PASS
FILTER
INPUT
OUTPUT
FL2
HIGH PASS
FILTER
INPUT
OUTPUT
B.
FL1
LOW PASS
OUTPUT
HIGH PASS
OUTPUT
PARALLELED
INPUT
FL2
C.
FL1
Cx
LOW PASS
OUTPUT
HIGH PASS
OUTPUT
Lx
PARALLELED
INPUT
FL2
FL1
OUTPUT AMPLITUDE
FREQUENCY
FL2
OUTPUT AMPLITUDE
FREQUENCY
FL1
FL2
RESULTANT
OUTPUT AMPLITUDE
FREQUENCY
OUTPUT AMPLITUDE
FREQUENCY

Figure 4-12. Frequency Discriminator,
Response Curve Derivation

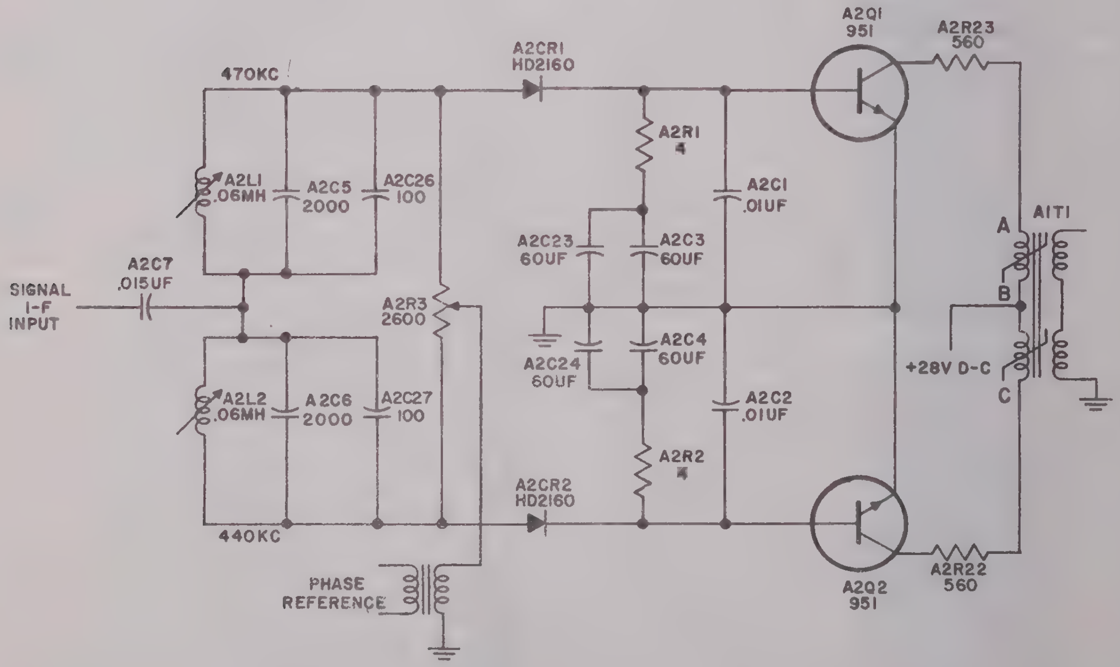

470KC
A2CR1
HD2160
A2Q1
951
A2R23
560
A2L1
.06MH
A2C5
2000
A2C26
100
A2R1
4
A2C1
.01UF
A2C23
60UF
A2C3
60UF
AIT1
A
B
C
A2C7
.015UF
SIGNAL
I-F
INPUT
A2R3
2600
A2C24
60UF
A2C4
60UF
+28V D-C
A2L2
.06MH
A2C6
2000
A2C27
100
A2C2
.01UF
A2R2
4
A2CR2
HD2160
440KC
PHASE
REFERENCE
A2Q2
951
A2R22
560

Figure 4-13. Model A Phase and Frequency Discriminator,
Simplified Schematic Diagram

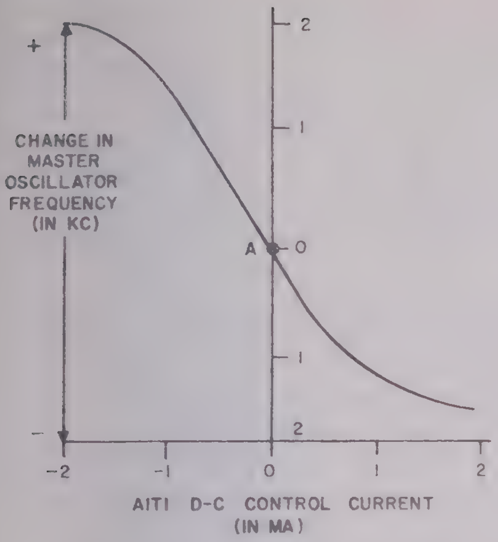


Figure 4-14. Curve of Saturable Control of Master Oscillator Frequency

the no-error operating point set by permanent magnetic bias of A1T1.

An i-f signal containing plus error is passed by the tuned circuit consisting of A2L1 and A2C5. A2CR1 rectifies the signal and applies the positive voltage to the base of A2Q1. The resulting greater current flow through the A to B winding of A1T1 produces a change of net flux in the associated core. This change of flux causes the inductance of the a-c winding to increase, with a resulting decrease of master oscillator frequency. Introduction of an i-f signal containing minus error causes heavier conduction in the other half of the discriminator. The resulting current in the B to C winding of A1T1 produces a net flux that decreases the inductance of A1T1 a-c winding, with a resulting increase of master oscillator frequency. The design of the frequency discriminator is such that it operates from outer limits of about plus or minus 20 kc into inner limits determined by the gain of the stabilizing loop. The outer limits are determined by mechanical filter A3FL2 which has a 40-kc band pass. The inner limits vary, depending on the amount of error, since the stabilizing loop gain is constant. A 2.5-kc master oscillator error multiplied by eight in the SMO to 20 kc will be corrected to about 1.5 kc by frequency discrimination. Frequency correction to less than 1.5 kc could be accomplished for smaller errors but is unnecessary due to initiation of phase discriminating at about 3.0 kc error.

When the error signal has been reduced to less than 3.0 kc, the phase discriminator assumes control of master oscillator frequency correction until it is phase locked to the reference oscillator or standard frequency. The i-f error signal, consisting of 455.0 kc plus or minus the 3.0-kc error, is beat with the 455.0-kc reference to obtain a 3.0-kc audio beat note which will cause the control winding current of A1T1 to vary at the audio rate and consequently frequency modulate the master oscillator. When this is fed back through the stabilizing loop, and the polarity of the beat note is in a direction to reduce the master oscillator error, the beat frequency is lower and has a longer half-cycle. When the polarity reverses, the beat frequency is higher and the length of the half-cycle is shortened. This distortion of the audio beat note causes it to have a d-c average that causes discriminator action to pull the master oscillator frequency toward no error. As the beat note decreases in frequency, the periods of half-cycles become longer and the d-c average increases, causing faster correction of the master oscillator frequency. When the master oscillator frequency is pulled within 90 degrees of phase lock with the reference, the discriminator circuit acts as a true phase discriminator as shown in figure 4-15.

The 455-kc reference phase signal, required to produce phase discriminating, is introduced to the discriminator circuit at the arm of potentiometer A2R3. A simplified schematic diagram of the discriminator is shown in figure 4-13. At the center frequency of 455 kc, the two tuned circuits appear primarily inductive and capacitive as shown in figure 4-12. With this input frequency, FL2 represents the tuned circuit consisting of A2L1, A2C5, and A2C26, (figure 5-107) and FL1 represents the tuned circuit consisting of A2L2, A2C6, and A2C27 (figure 5-107). Refer to figure 4-15. The error signal source is represented by a generator and the total load by resistors R1 and R2.

The inductive and capacitive elements provide a phase-shift network that causes E_{ab} to be approximately 170 degrees out of phase with E_{bc}. The error signal voltage and current are in phase with each other but have about an 85-degree relation to E_{ab} and E_{bc}. In a condition of no-error input, the resultant vector sums of E_{R1} and E_{R2} are of equal amplitude. These voltages cause equal conduction through each half of the discriminator and the load. Since the load contains the d-c windings of A1T1 (figure 4-12), the currents through the windings are equal and produce core fluxes that cancel. Thus no control is exerted on the master oscillator frequency. Figure 4-15A shows the discriminator equivalent circuit, and figure 4-15B shows the voltage vector relationship at balance. Figure 4-15C illustrates the vector relation with positive correction in which E_{R2} is of greater amplitude than E_{R1}. This causes a greater current to flow through the lower winding of A1T1. The current produces a net core flux that causes the inductance of the a-c winding to increase, with a consequent decrease of master oscillator frequency. Figure 4-15D illustrates a reverse situation with negative correction.

The complementary filter arrangement also provides impedance matching of the signal i-f amplifier to the discriminator circuit. Impedance matching is necessary to achieve maximum transfer of power. The output impedance of the last signal i-f amplifier stage is approximately 15,000 ohms. The input impedance of the discriminator is approximately 400 ohms. Figure 4-16 illustrates the impedance match-

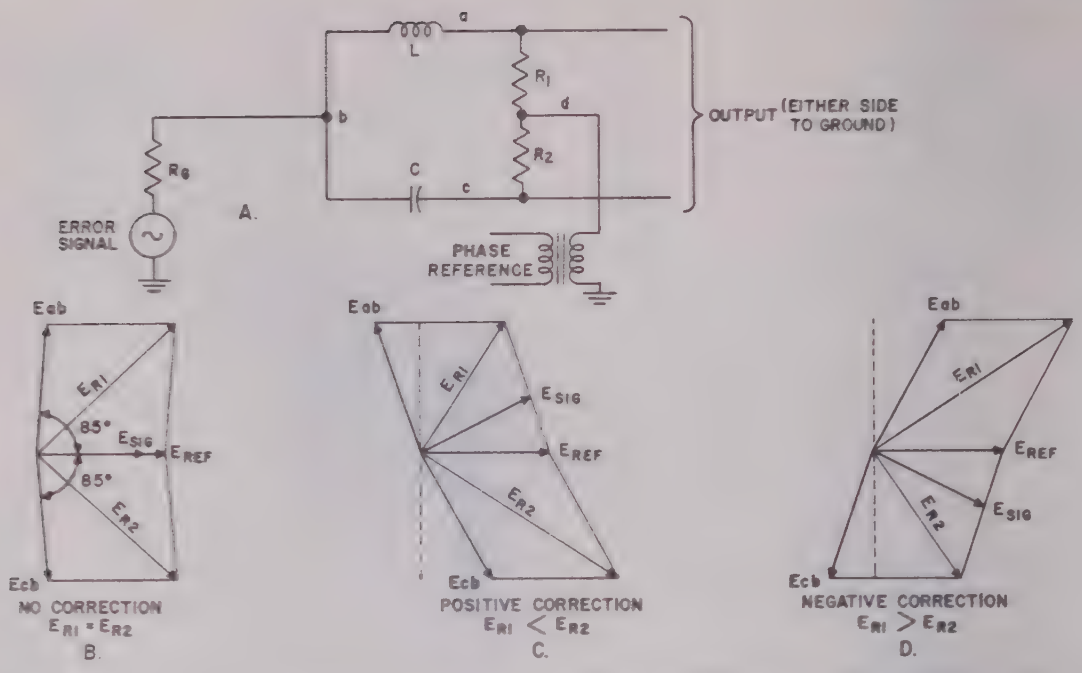

L
a
R1
d
b
R2
C
c
RG
A.
ERROR SIGNAL
OUTPUT (EITHER SIDE TO GROUND)
PHASE REFERENCE
Eab
ER1
85°
ESIG
EREF
85°
ER2
Ecb
NO CORRECTION
ER1 = ER2
B.
POSITIVE CORRECTION
ER1 < ER2
C.
NEGATIVE CORRECTION
ER1 > ER2
D.

Figure 4-15. Phase and Frequency Discriminator, Equivalent Circuit

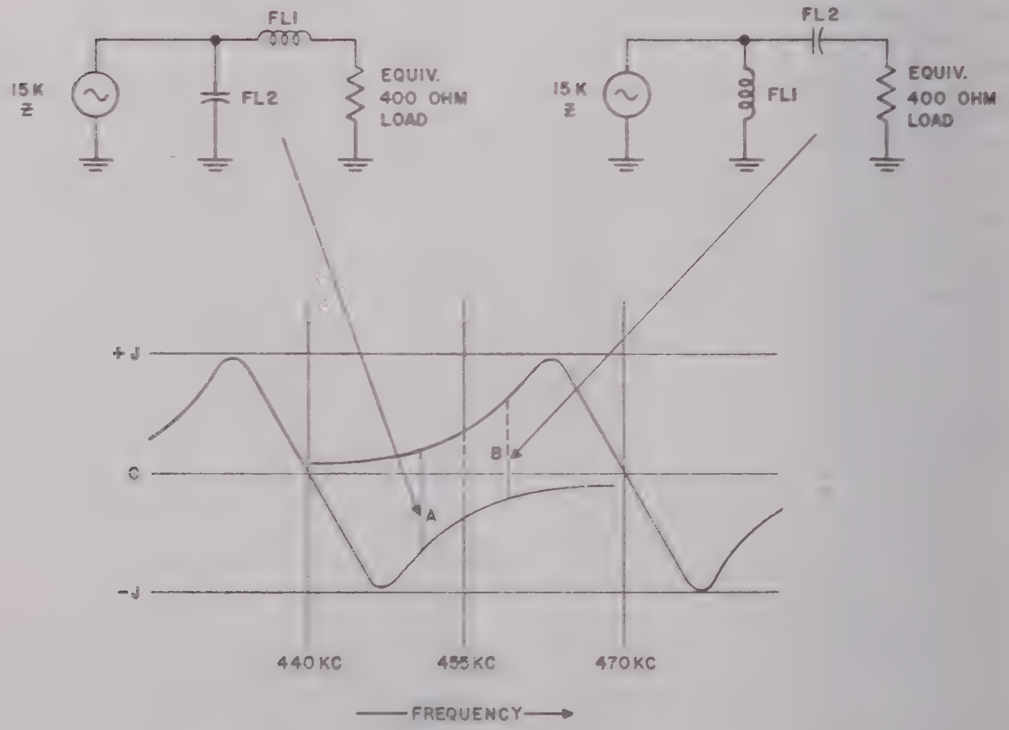

FL1
15K Z
FL2
EQUIV. 400 OHM LOAD
FL2
15K Z
FL1
EQUIV. 400 OHM LOAD
+J
C
-J
A
B
440 KC
455 KC
470 KC
FREQUENCY

Figure 4-16. Discriminator Tuned Circuits, Frequency Versus Reactance Curves

ing properties of the complementary filter circuits. The response curves shown are representative plots of filter reactance versus frequency for the two filters. The filter shown for the reactance values at A appears as a pi section that will match the 15,000-ohm generator impedance to the 400-ohm load. The filter shown for the reactance values at B performs identically. These points were chosen to occur at the points of maximum discriminator sensitivity and are variable to permit alignment procedures to obtain the condition just mentioned.

Refer to figure 5-107. Both the master oscillator and signal i-f amplifier subassemblies are provided with heater elements to assist in maintaining temperature stability of the circuits. Heater element A1HR1, in the master oscillator subassembly, maintains the subassembly above +25°C (+77°F). Thermal switch A1S1 removes the a-c power to A1HR1 when +25°C is attained. Thermal A1S1 is closed, prevents master oscillator (MO) signal output until the module internal temperature has reached [illegible] (+[illegible]°F). The MO components stabilize at +25°C (+77°F) and maintain the oscillator subassembly moisture free. The heater element, located on the signal i-f amplifier circuit board, is wound around a compartment which contains the temperature-sensitive components of the phase and frequency discriminator. A2HR1 and thermal switch A1S1 maintain a temperature of 75°C (167°F). The enclosed components include the tuned circuits, diodes, transistors, and thermal switch, as shown by the dotted lines in figure 5-107.

The agc circuit of the signal i-f amplifier is controlled in several ways. The agc line is shorted to ground when the OPERATE-TUNE switch on the front panel is depressed after the frequency has been selected. During the manual frequency selection, the discriminator can readily lock on an undesired spurious signal. It is necessary, therefore, to recycle the signal i-f amplifier, the discriminator, and the agc circuits by grounding agc after tuning is complete. The time delay of A2C11 and A5C25 charging through A2R6, after agc ground is removed, prevents the discriminator from locking on frequency until the signal i-f amplifier builds up the i-f signal. Grounding of the agc line also grounds the base circuits of capacitors A2C32 and A2C33 to the two parallel-tuned tank circuits of the frequency discriminator.

The tank circuit consisting of A2L1, A2C25, and A2C26 is tuned to resonate at frequencies above the no-error 455-kc i-f signal, and the tank circuit consisting of A2L2, A2C6, and A2C27 is tuned to resonate at frequencies below the no-error 455-kc i-f signal. These tank circuits perform dual functions by providing nearly constant impedance matching between A2Q3 output tank circuit and the frequency discriminator circuit, and by providing discriminating action to assist master oscillator (MO) frequency correction. The tank circuits of the discriminator are connected in a complementary filter arrangement, which also provides a desirable discriminator response curve.

Resistors A2R25, A2R26, A2R27, A2R28, A2R29, A2R30, and A2R31 form a voltage-divider network for the voltage-variable capacitor, A1C11. This network is maintained at a constant d-c potential (+16 volts d-c at pin E of A2P1) from the +28-volt d-c supply by Zener diode A1CR1. The action of the frequency and phase discriminator is to add or subtract voltages from the steady-state regulated supply voltage applied to the voltage-variable capacitor, AC11, located in the grid tuning circuit of the master oscillator. The capacitance of A1C11 varies as follows: An increase in voltage decreases capacitance, a decrease in voltage increases capacitance. Introduction of a 455-kc signal to the tank circuits of the discriminator causes equal conduction in each half of the discriminator during the positive alternation. The resulting currents are rectified by diodes A2CR1 and A2CR2 and flow through resistors A2R25 and A2R26 respectively. The d-c currents through these resistors are equal and 180 degrees out of phase; therefore, no voltage change occurs at voltage variable capacitor A1C11. In this condition the discriminator is balanced and the net control exerted on A1C11 is zero.

An i-f signal containing error that places it below 455.0 kc is passed by the tuned circuit consisting of A2L2, A2C6, and A2C27. A2CR2 rectifies the first and second signal i-f amplifiers, A2Q6 and A2Q5, which prevents them from conducting since they require about +0.3 volt or more on their bases to cause them to conduct. Recharging of the agc filter is not completed until shortly after removing the agc ground at which time the agc turns on the i-f amplifiers. Disabling the i-f amplifiers prevents the discriminator from following the mechanical tuning cycle which could prevent the desired electronic positioning and phase lock of the master oscillator frequency. When no signal is present in the signal i-f amplifier subassembly, the agc line is maintained at about +0.8 volt positive by voltage divider A2R18-A2R19 to maintain A2Q5 in an operating condition. When a signal is introduced to the signal i-f subassembly, the agc voltage derived controls A2Q5 and A2Q6 conduction. The agc line is clamped by diode A2CR4 to prevent the bases of A2Q5 and A2Q6 from going more than +0.9 volt positive which would damage the transistors. A second delay circuit consisting of A2R4, A2R5, and A2C8 is used to delay the bias on the agc diode A2CR3 to promote agc voltage that will control the drive to the discriminator circuit and, consequently, to A2Q1 and A2Q2. This function is performed in the following manner. When A2Q1 and A2Q2 are subjected to temperature rise, their characteristics cause them to conduct heavier with the same amount of input signal. Consequently, the increased collector current causes a decrease in collector voltage which appears across voltage divider A2R4 and A2R5. The decrease in voltage appears at the cathode of A2CR3 permitting it to conduct earlier. This reduces the drive to the signal i-f amplifier input which reduces the drive to the discriminator circuit. This provision prevents A2Q1 and A2Q2 from being damaged by excessive current.

A2C8 in the delay circuit functions as an r-f bypass to prevent r-f from feeding onto the agc line.

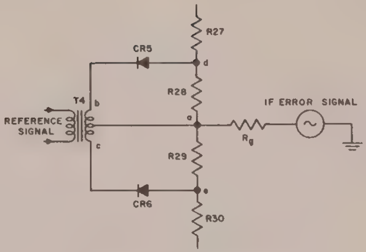
(m) SIGNAL I-F AMPLIFIER FOR STABILIZED MASTER OSCILLATOR, MODEL B AND MODEL C. - Refer to figure 5-106 or 5-107 for schematic diagram. Refer to the previous paragraphs for a description of the four i-f amplifier stages, as models B and C are identical to model A in this respect. The i-f signal is taken from the output tank circuit of i-f amplifier A2Q3 and is coupled through capacitors A2C32 and A2C33 to the two parallel-tuned tank circuits of the frequency discriminator.

The tank circuit consisting of A2L1, A2C25, and A2C26 is tuned to resonate at frequencies above the no-error 455-kc i-f signal, and the tank circuit consisting of A2L2, A2C6, and A2C27 is tuned to resonate at frequencies below the no-error 455-kc i-f signal. These tank circuits perform dual functions by providing nearly constant impedance matching between A2Q3 output tank circuit and the frequency discriminator circuit and by providing discriminating action to assist master oscillator frequency correction. The tank circuits of the discriminator are connected in a complementary filter arrangement, which also provides a desirable discriminator response curve.

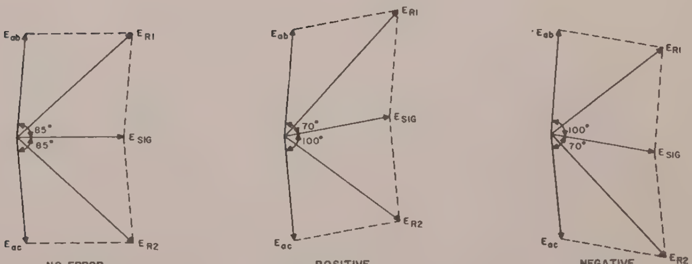
Resistors A2R25, A2R26, A2R27, A2R28, A2R29, A2R30, and A2R31 form a voltage-divider network for the voltage-variable capacitor A1C11. This network is maintained at a constant d-c potential (±16 volts dc at pin E of A2P1) from the ±28-volt d-c supply by Zener diode A1CR1. The action of the frequency and phase discriminator is to add or subtract voltages from the steady-stage regulated supply voltage applied to the voltage-variable capacitor, A1C11, located in the grid tuning circuit of the master oscillator. The capacitance of A1C11 varies as follows: An increase in voltage decreases capacitance, a decrease in voltage increases capacitance. Introduction of a 455-kc signal to the tank circuits of the discriminator causes equal conduction in each half of the discriminator during the positive alternation. The resulting currents are rectified by diodes A2CR1 and A2CR2 and flow through resistors A2R25 and A2R26 respectively. The d-c currents through these resistors are equal and 180 degrees out of phase; therefore, no voltage change occurs at voltage variable capacitor A1C11. In this condition the discriminator is balanced and the net control exerted on A1C11 is zero.

An i-f signal containing error that places it below 455.0 kc is passed by the tuned circuit consisting of A2L2, A2C6, and A2C27. A2CR2 rectifies the signal which results in a decrease in voltage at A1C11. The decrease in voltage increases the capacitance of A1C11 with a resultant decrease in master oscillator frequency. Introduction of an i-f signal containing error that places it above 455.0 kc causes heavier conduction in the other half of the discriminator resulting in an increase in voltage at A1C11. The increase in voltage decreases the capacitance of A1C11 with a resultant increase in master oscillator frequency. The frequency discriminator operates from outer limits of about plus or minus 20.0 kc (30.0 kc in model C) into inner limits determined by the gain of the stabilized loop. The outer limits are determined by mechanical filter A3FL2 in the i-f mixers subassembly which has a 40-kc (60-kc in model C) band pass. The inner limits vary depending on the amount of error since the stabilizing loop gain is constant. A master oscillator error multiplied to 20.0 kc (or 30.0) will be corrected to about 1.5 kc by frequency discrimination. Frequency correction of less than 1.5 kc could be accomplished for smaller error but is unnecessary due to initiation of phase discriminating at about 2.2 kc error. Resistor A2R27 isolates and couples the frequency and phase discriminator outputs.

When the error signal is less than 2.2-kc, the phase discriminator assumes control of master oscillator correction. The i-f error signal, consisting of 455.0 kc plus or minus the 2.2-kc error, is beat with a 455.0-kc reference to obtain a 2.2-kc audio beat note. The audio beat note causes the control voltage of voltage variable capacitor A1C11 to vary at an audio rate which causes the capacitance of A1C11 to change at an audio rate. This action causes the master oscillator to be frequency modulated. The frequency-modulated master oscillator frequency then is fed through the stabilizing loop. When the polarity of the beat note signal is in a direction that reduces the original error, the beat frequency is lower and has a longer half-cycle. When the beat note polarity reverses, the beat frequency is higher and the length of the half-cycle is shorter. This distortion of the audio beat note causes it to have a d-c average that causes discriminator action to pull the master oscillator frequency toward no error. As the beat note decreases in frequency, the periods of half-cycle time become longer, and the d-c average becomes greater. This action causes the master oscillator frequency to be corrected even more. When the master oscillator frequency is pulled within 90.0 degrees of the reference, the phase discriminator circuit phase locks and provides an error signal that will correct and maintain the master oscillator to the corrected frequency. See figure 4-17A. The 455-kc reference phase signal required to produce phase discriminating is introduced at the primary of A2T4. The i-f signal is introduced at the center tap of A2T4 secondary. Introduction of a no-error 455-kc signal at A2T4 secondary causes A2CR5 and A2CR6 to conduct equally through resistors A2R28 and A2R29 respectively. The d-c current through these resistors is equal and 180 degrees out of phase; therefore, no voltage change occurs at voltage variable capacitor A1C11. Thus, no control is exerted on the master oscillator frequency. A 455-kc i-f error signal voltage with a phase relative to the reference signal components as shown in figure 4-17C will cause A2CR5 to conduct heavier which results in an increase in voltage at A1C11 with a resultant increase in master oscillator frequency. An i-f signal voltage with phase position as shown in figure 4-17D will cause A2CR6 to conduct more and result in a decrease in voltage at A1C11 with a resultant decrease in master oscillator frequency.



SIMPLIFIED PHASE DISCRIMINATOR
A.



NO ERROR
$E_{R1} = E_{R2}$
B.

POSITIVE CORRECTION
$E_{R1} > E_{R2}$
E_{de}=NEGATIVE
C.

NEGATIVE CORRECTION
$E_{R1} < E_{R2}$
E_{de}=POSITIVE
D.

Figure 4-17. Model B Phase Discriminator, Vector Diagrams

Summing the frequency and phase discriminating action, assume a master oscillator error of 2.5 kc. When multiplied, this error becomes 20.0 kc at the discriminator. Frequency discriminating characteristics will cause derivation of d-c control voltage for A1C11 that will cause the master oscillator error to be corrected to less than 2.0 kc. Phase discriminating action then is initiated to derive the audio beat note that is used to frequency modulate the master oscillator. This correction will pull master oscillator to within 90 degrees of the reference at which time the phase discriminator corrects master oscillator error and maintains it in phase lock.

(n) 4-KC SPECTRUM GENERATOR SUBASSEMBLY. - A 4-kc signal from the frequency divider module is delivered to the SMO through terminal 34 of receptacle P1 and coupled through coaxial cable to terminal A of receptacle A6P1 of the 4-kc spectrum generator subassembly. The 4-kc signal is coupled through capacitor A6C1 and applied to a monostable transistorized multivibrator, A6Q1 and A6Q2. With no signal input, normally A6Q1 is cut off while A6Q2 is conducting. Transistor A6Q2 is connected across the collector tank circuit of a transistor oscillator, A6Q3, loading the tank and preventing the oscillator from operating. Oscillator A6Q3 functions as a tuned-collector, inductance-coupled oscillator using heavy feedback to promote fast starting and stopping. Transistor A6Q3 produces an output of 1050 kc when permitted to oscillate. The introduction of the 4-kc sine wave signal to the base of A6Q1 drives it into conduction causing A6Q2 to cut off. The pulse generator operates only on positive alternations of the input signal due to clamping diode A6CR1 in the base circuit of A6Q1. The pulse generator produces narrow pulses in the output due to the small time constant of the time-determining elements A6C3 and A6R5 and the base resistance of A6Q2. Whenever A6Q2 is cut off, it unloads the tank circuit of A6Q3 permitting it to oscillate for the duration of the pulse applied to the pulse generator. This time is selected to permit an output of about eight cycles. When the 4-kc pulse initiates the 1050-kc oscillation, each eight-cycle 1050-kc oscillation is initiated at the same point, namely the zero degree phase point, as the oscillator has been turned off in the 4-kc off period immediately preceding turn-on. It is this feature which assures that the free-running 1050-kc oscillator will be phase locked to the 4-kc reference signal. The eight-cycle output spectrum, centered at 1050 kc, appears across the collector tank circuit of A6Q3. This signal is applied to filter A6FL1, which has a band pass of 1000 to 1100 kc, to pass twenty-five 4-kc spectrum points centered around the oscillator frequency of 1050 kc. A6FL1 smooths out the pulsed spectra to provide a 4-kc continuous spectrum output. The output A6FL1 is applied to the control grid of the fourth mixer, A6V1. The mixing signal for A6V1 is supplied by the interpolation oscillator. The frequency supplied by the interpolation oscillator is the same as the injection it supplies to the third mixer in the i-f mixers subassembly (549 to 645 kc in 4-kc steps). The interpolation oscillator signal is introduced into the 4-kc spectrum generator subassembly through terminal F of receptacle A6P1 and applied to the suppressor grid of fourth mixer A6V1. Mixing of the 4-kc spectrum signal and the interpolation oscillator injection signal produces sum and difference frequencies in the plate output. The 455-kc output is determined by a mechanical filter located in the reference i-f amplifier subassembly.

(o) REFERENCE I-F AMPLIFIER SUBASSEMBLY. - The spectrum output of the 4-kc spectrum generator subassembly is taken from terminal K of A6P1, coupled through coaxial cable, and applied to terminal B of receptacle A7P1 of the reference i-f amplifier subassembly. The signal then is applied to the tuned input of mechanical filter A7FL1. Filter A7FL1 is a 455-kc filter with a 2-kc bandpass characteristic that rejects all 4-kc spectrum points and the interpolation oscillator frequency, but passes the 455-kc difference frequency of the interpolation oscillator frequency and one of the 4-kc spectrum points. The output of A7FL1 is connected across series capacitors A7C2 and A7C3 which provides tuning of the A7FL1 output while providing impedance matching between the filter and the base circuit of the first i-f amplifier. The i-f amplifier consists of three cascaded transistor stages one of which is agc controlled. The 455-kc signal applied to the base of A7Q1 is amplified and applied to a tuned circuit consisting of A7C5 in parallel with the variable primary of i-f coupling transformer A7T1. Transformer A7T1 is a step-down transformer which provides coupling of the i-f signal and impedance matching of the collector circuit of A7Q1 to the base circuit of A7Q2. The collector output of A7Q2 is developed across a tuned autotransformer A7L2. Output is taken from a tap and applied to the base of A7Q3. The d-c feedback is taken from the emitter of A7Q3 and delivered to the base of A7Q2 through A7R5 for bias stabilization. The collector output of A7Q3 is developed across the tuned primary of A7T2. One of the two secondary windings of A7T2 couples the 455-kc reference i-f signal to terminal K of receptacle A7P1, and the other couples a portion of the signal to the agc circuit. The agc circuit is very similar to the one used in the signal i-f amplifier subassembly. Diode A7CR2 provides rectification of the signal during negative alternations and is provided with a delay circuit consisting of A7C7 and A7R12. Resistors A7R12 and A7R9 serve as a voltage divider from the +28-volt d-c supply to obtain +0.8 volt on the agc line with no signal input. Resistors A7R10 and A7R11 form a voltage divider to provide agc delay voltage. Resistors A7R3 and A7R8 form a bleeder to set the conduction time of A7CR1 which provides a clamp on the agc line to prevent it from going positive except for small amounts (+0.9 volt maximum). The 455-kc i-f output taken from terminal K of receptacle A7P1 is coupled through coaxial cable and applied to the signal i-f amplifier subassembly through terminal L of receptacle A2P1 for use as the reference of the phase and frequency discriminator.

(p) AFC METER AMPLIFIER. - An AFC meter amplifier is used in the model B and model C stabilized master oscillator modules (figures 5-106 and 5-107). It is necessary to isolate the low-impedance meter from the high-impedance discriminator output with an amplifier to prevent excessive loading of the discriminator. The AFC meter amplifier is a cathode-follower circuit consisting of a dual triode, A8V1. Variable resistor A8R1 is used to balance the two halves of the tube A8V1. The tube is balanced when the AFC meter reads zero with no drive from the discriminator. Resistors A8R2 and A8R3 are the cathode resistors. Resistors A8R5 and A8R6 are used as voltage dividers across the 27.5-volt line. This will put the tube A8V1 +16 volts above ground which is necessary to overcome the +16 volts that is applied to the grid (pin 7) of A8V1. The drive from the discriminator will cause the bias to the grid of the tube to increase or decrease, causing current to flow. This is indicated on the AFC meter. Resistor A8R7 is a multiplying resistor for the meter. The model C SMO has a larger pull-in range than the model B which causes more current to flow through the AFC meter making it read off scale. To prevent off-scale reading, multi-

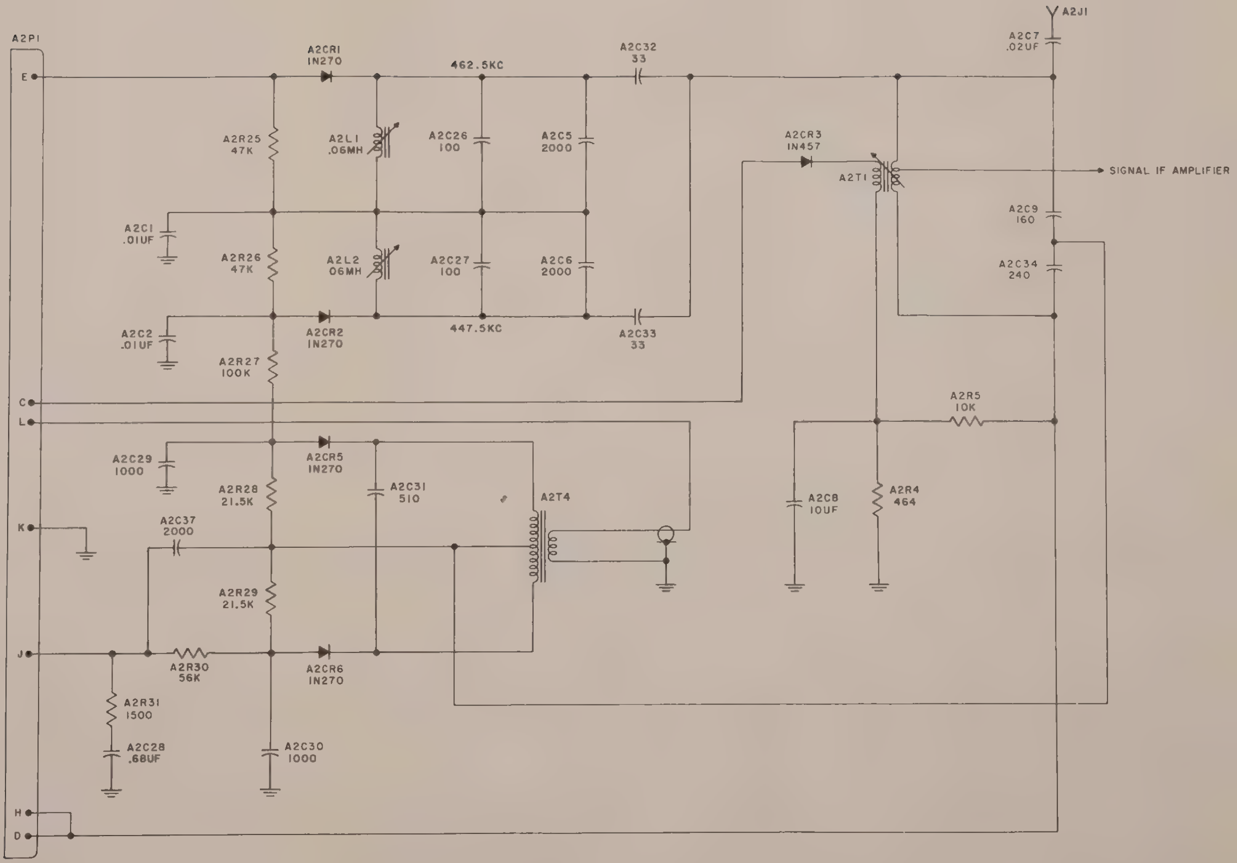

A2PI
E
C
L
K
J
H
D
A2CRI
IN270
462.5KC
A2C32
33
A2J1
A2C7
.02UF
A2R25
47K
A2L1
.06MH
A2C26
100
A2C5
2000
A2CR3
IN457
A2T1
SIGNAL IF AMPLIFIER
A2C1
.01UF
A2C9
160
A2R26
47K
A2L2
.06MH
A2C27
100
A2C6
2000
A2C34
240
A2C2
.01UF
A2CR2
IN270
447.5KC
A2C33
33
A2R27
100K
A2R5
10K
A2C29
1000
A2CR5
IN270
A2R28
21.5K
A2C31
510
A2T4
A2C8
10UF
A2R4
464
A2C37
2000
A2R29
21.5K
A2R30
56K
A2CR6
IN270
A2R31
1500
A2C28
.68UF
A2C30
1000

Figure 4-18. Model B and Model C Phase and Frequency Discriminator, Simplified Schematic Diagram

plying resistor A8R7 is changed to a larger value. Diodes A8CR1 and A8CR2 are used to prevent excessive overload current from damaging the meter. The diodes will let the meter pin but will not let it go beyond that point.

(q) SIDESTEP OSCILLATOR MODULE. - The schematic diagram of the sidestep oscillator module is shown in figure 5-104. The 2.4-mc signal from the reference oscillator and the 1-kc signal from the frequency divider are coupled into the sidestep oscillator module through terminals D and A of P1 respectively. The 1-kc signal is applied to a monostable multivibrator, Q1 and Q2. This stage functions as a pulse generator and produces a 1-kc pulse that is coupled to the control grid of mixer V1 and keys V1 into conduction at a 1-kc rate. This action causes the 2.4-mc signal on the suppressor grid to have a 1-kc spectrum impressed upon it. Mixer V1 requires another input for mixing to provide a usable output. This input signal is supplied by a crystal-controlled oscillator, V2. Four relay-selected crystals, in the control grid circuit of V2, determine the operating frequency of the oscillator. The crystals are selected, one at a time, by relays K1 and K2 which are operated automatically when a frequency selection change is made at the front panel with the FREQUENCY CHANGE control and BAND CHANGE switch. The four operating frequencies available from the oscillator are 1.945, 1.944, 1.943, and 1.942 mc. The 1.945-mc crystal is not used in all AN/URC-32( ) configurations, since sidestep oscillator bypass relay K1 (on frequency generator (CV-731)URC chassis) allows the reference oscillator module signal of 2.4 mc to be fed directly to the SMO module. The plate output of V2 is coupled through capacitor C13 and applied to the suppressor grid of the first mixer, V1. The 2.4-mc signal containing the 1-kc spectrum is beat with the oscillator signal to produce a difference frequency of 455 kc. This signal is passed through a 455-kc mechanical filter, FL1, which has a band pass of 200 cps. The filter rejects the oscillator signal, the 2.4-mc signal, and adjacent spectrum signals which are 1 kc above or below the desired signal, but will pass any oscillator errors that fall within the pass band of FL1. The 455-kc signal, plus or minus the oscillator error, is applied to the control grid, lead 1, of amplifier V3 whose amplified output is tuned by the circuit consisting of C21, C22, and the primary winding of transformer T1. The signal from the secondary winding of T1 is impressed on the control grid of mixer, V4. Also coupled to the second mixer stage is a signal from the cathode of oscillator V2. This signal is the same frequency as the oscillator plate output used at the first mixer V1. This signal is coupled through capacitor C24 and applied to the suppressor grid of mixer V4. The parallel-tuned circuit consisting of L2 and C25 is tuned to the output of crystal oscillator V2. Any frequency drift that may be present in the 455-kc signal on the control grid of V4 also is present in the oscillator signal at the suppressor grid. The two signals are mixed in the electron stream of V4, and the sum frequency taken from the plate appears across the parallel-tuned circuit consisting of the primary winding of transformer T2 and capacitor C26. Because the crystal oscillator outputs were subtractively mixed in V1, and additively mixed in V4, the crystal frequency error is canceled out and the 2.397-, 2.398-, and 2.399-mc outputs are as accurate as the 2.4-mc and 1-kc inputs. The output signal is taken from the secondary winding of T2 and applied to terminals A and B of receptacle P2 for use as an input to the SMO module.

(r) FREQUENCY DIVIDER MODULE.

1. INPUT AMPLIFIER. - The 100-kc signal from the reference oscillator module is coupled from connector P1-A through capacitor C1 to the base of the input amplifier, Q1. The base of Q1 is positively biased by the voltage divider consisting of R1 and CR1 from B+ to ground. Diode CR1 is polarized to present a high backward resistance as part of the voltage divider. This presents a high impedance to ground for positive half-cycles of 100-kc signal and low impedance to ground for negative half-cycles of 100-kc signal, resulting in square-wave, positive half-cycle input to the base of amplifier Q1. The square-wave output of Q1 is applied across resistor R2 and the primary winding of T1 (in series) and is differentiated to a spiked waveform. Resistor R18 loads the primary winding of T1 and limits the peak voltage swing across it.

2. 20-KC DIVIDER. - Refer to figures 4-19 and 4-20. Transistors Q2 and Q3 are connected in a free-running multivibrator circuit. The two secondary windings of transformer T1 are oriented so that the spike obtained across the primary is added to the base potentials of Q2 and Q3. The total capacitor discharging times of the two RC circuits in the base connections to the two transistors are different. The discharge time can be called the free-running time and is related to the RC product approximately by period = 2/3 RC. The period determined by R4 and C2 in the base lead of Q2 is about 35 usec, and that of R5 and C3 in the base of Q3 is about 25 usec. The 100-kc input produces 10-usec triggering pulses that are coupled through T1 to the bases of Q2 and Q3 where they become superimposed upon the discharging voltage. The shape of the discharging voltage curve permits one of the 10-usec pulses to cause a transistor to begin conducting collector current before the 35- (or 25-) usec period has actually been completed. Thus the 10-usec pulses lock Q2 to a 30-usec off period and a 20-usec on period. This produces a total cyclic period of 50 usec for the multibrator Q2 and Q3 which produces a 20-kc output frequency. Diodes CR3 and CR4 prevent emitter breakdown.

Refer to figure 4-20. Assuming that Q2 fires first, the drop in collector voltage is translated to the base of Q3. When Q2 collector voltage has reached minimum, capacitor C3 begins to discharge at a rate determined by the product of R5 and C3 causing Q3 base voltage to rise. The total time required for this voltage to rise high enough to bias Q3 into conduction is 25 usec. The 100-kc pulses appear every 10 usec as spikes superimposed upon the rising voltage at point A. Figure 4-20 represents the oscilloscope pattern of the triggering voltage at point A of figure 4-19. Since the amplitude of the 100-kc pulses is great enough to exceed the critical base bias voltage of Q3 5 usec before the 25-usec discharge time has elapsed, Q3 will conduct 20 usec after Q2. The Q3 collector voltage drop is transferred to the base of Q2, immediately cutting off conduction of Q2. The third 10-usec locking pulse on the discharging voltage at point B (figure 4-19) triggers Q3 back into conduction 5 usec before the 35-usec RC time has elapsed. This arrangement allows Q2 to conduct for 20 usec and Q3 to conduct for 30 usec, providing a total period of 50 usec for the multivibrator producing 20-kc output to the primary of transformer T2.

3. 4-KC DIVIDER. - Transistors Q4 and Q5 are connected in a free-running multivibrator circuit similar to that of Q2 and Q3. The 20-kc square-wave signal from the collector of Q3 is applied across R6 and the primary of T2 (in series) where it is differentiated to a spiked waveform having a period of 50 usec between pulses. The dividing action is accomplished in the same manner as in the 20-kc multivibrator. The period in the base circuit of Q4 (determined by R8 and C4, see figure 5-5) is 175 usec. The 50-usec triggering pulses (from the 20-kc input) lock Q4 to a 150-usec of time. The period in the base circuit of Q5 (determined by R9 and C5) is 125 usec. The 50-usec and triggering pulses lock Q5 to a 100-usec off time. The total time period of the multivibrator is 250 usec, and the output frequency produced is 4 kc. The 4-kc output is taken from the Q5 collector, filtered and integrated by resistor R11 and capacitor C6, then coupled through capacitor C7 as an output to the stabilized master oscillator module.

4. 1-KC DIVIDER. - The action of the 1-kc divider is exactly like that of the 20-kc and 4-kc dividers except that the two base circuit time constants are equal because the frequency is being divided by an even number. The free-running time period for both Q6 and Q7 is 625 usec. The 4-kc input from the 4-kc divider produces triggering pulses of 250 usec that lock Q6 and Q7 at 500 usec each. The total cyclic period for the Q7-Q6 multivibrator is 1000 usec, producing a 1-kc square-wave output. This output is filtered and integrated by resistor R16 and capacitor C12 and coupled through capacitor C13 to pin P1-H, where it is used as an input to the sidestep oscillator module. The frequency divider module is isolated from the power supply and any other associated equipment by a filter consisting of inductor L1; resistor R17; and capacitors C14, C15, and C16. Test jacks J1, J2, and J3 are accessible at the top of the module when it is mounted on the chassis.

(s) REFERENCE OSCILLATOR MODULE.

1. CRYSTAL OSCILLATOR AND REGENERATIVE DIVIDERS. - Figure 5-109 the schematic diagram of reference oscillator module. The crystal-controlled oscillator circuit uses a 3.0-mc quartz crystal, Y1. A series-tuned circuit, consisting of a variable, inductance-tuned coil, L1, and

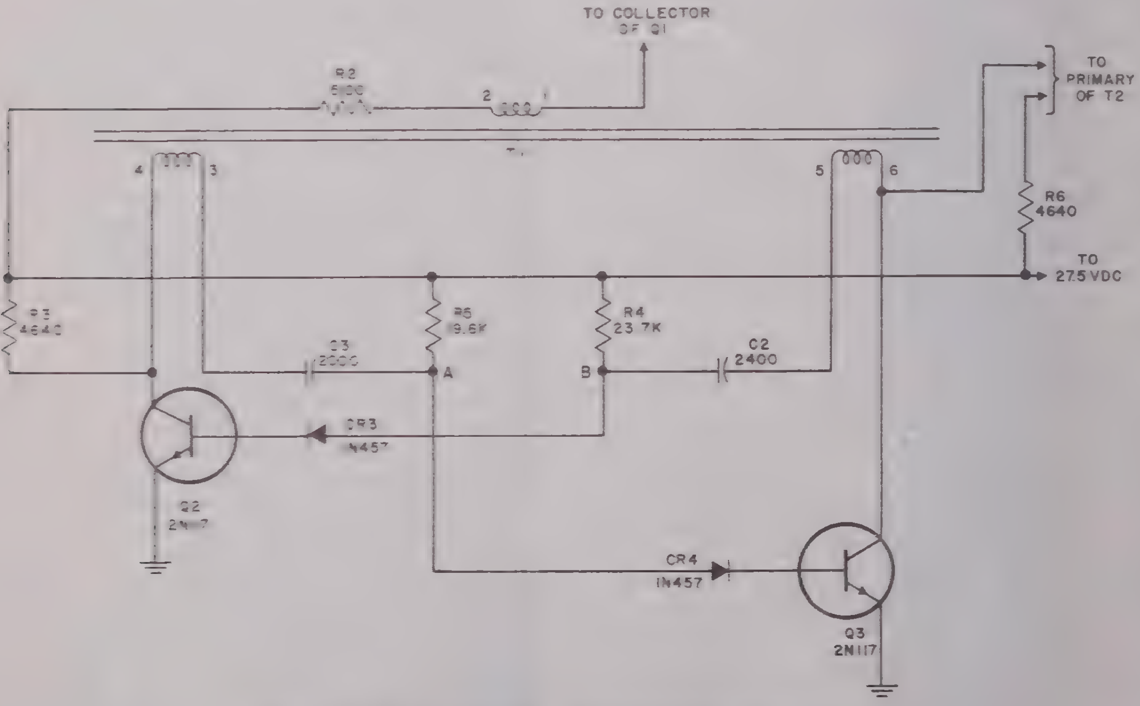


Figure 4-19. 20-Kc Divider, Simplified Schematic Diagram

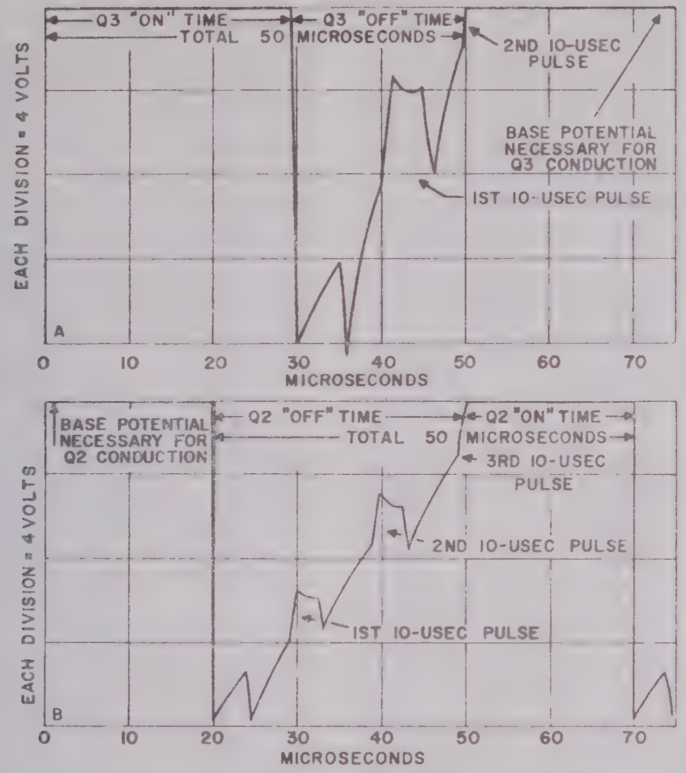


Figure 4-20. 20-Kc Divider, Base Voltage Waveforms

capacitor C3, is provided to permit fine tuning adjustment of the oscillator to compensate for aging effects. Transistor Q5 is an oscillator with feedback from the collector through the 3.0-mc crystal to the base. Variable inductor L1 permits calibration adjustments. Output from the collector-tuned circuit, L2 and C5, is coupled through capacitor C6 to the base of the 3.0-mc buffer, Q6. Untuned collector output from the buffer is coupled through capacitor C8 to the emitter of the 600-kc mixer, Q7. The 600-kc output from the Q7 collector-tuned circuit is connected to the base of multiplier Q10, the collector circuit of which is tuned to 2.4 mc by L5, C24, C25, and C26. The 2.4-mc output from the top of capacitive divider (C24 and C25) is connected back to the base of mixer Q7 where it is mixed with 3.0 mc to produce a 600-kc frequency in Q7 collector circuit. A portion of the 2.4-mc output from the collector circuit of Q10 is coupled through capacitor C31 to the base of the 2.4-mc output amplifier, Q12. The untuned output from the collector of Q12 is coupled through capacitor C33 to receptacle P1-D for delivery to the sidestep oscillator module and the stabilized master oscillator module. The output from the collector circuit of mixer Q7 is coupled through capacitor C12 to the base of the 600-kc buffer, Q8. The untuned 600-kc output from Q8 collector is coupled through capacitor C14 to the emitter of 100-kc mixer Q9. The collector of Q9 is tuned to 100 kc by L4, C15, C16, and C17. The 100-kc output from the capacitive divider, C15 and C16, of Q9 collector circuit is connected to the base of multiplier Q11. The collector of Q11 is tuned to 500 kc by inductor L6, variable capacitor C30, and capacitive divider C28 and C29. The 500-kc output from the junction of the capacitive divider in Q11 collector circuit is connected to the base of 100-kc mixer Q9. The 600-kc and 500-kc signals are mixed in Q9 to produce the 100-kc signal in Q9 collector tank circuit. The 100-kc output from Q9 collector circuit is coupled through capacitor C34 to the base of 100-kc output amplifier Q13. The collector circuit of Q13 is tuned to 100 kc by L7, C36, C37, and C38. The output from this tuned circuit is connected to pin F of receptacle P1 for delivery to the frequency divider and the SMO modules of the frequency generator (CV-731/URC) and to the sideband generator (AM-2064/URC) Dividing action is started in both regenerative divider loops by electrical noise in the tuned circuits of the loops.

2. OVEN CONTROL CIRCUIT. - Refer to schematic diagram 5-109. Since the frequency accuracy of the equipment depends on the stability of the reference oscillator, an oven circuit is employed to stabilize the crystal of the oscillator against ambient temperatures. The crystal, Y1, and a heater, HR1, are closed in an insulated envelope for ambient thermal isolation. This unit is temperature controlled at +80°C (176°F) by a proportional feedback circuit consisting of the heater and a transis-

torized audio amplifier tuned to approximately 5 kc. The oven heater is a Wheatstone bridge in which two of the bridge arms are composed of nickel wire, and the other two bridge arms are made of a low-temperature coefficient alloy. The oven heater acts as both heater and temperature-sensing element. When the bridge is balanced, the resistance of the bridge arms is equal. This condition is predetermined to occur at +80°C (176°F). When the bridge is below balance temperature, there is a positive feedback around the audio amplifier loop, and power is applied to the heater arms of the bridge. As the bridge heats, it comes closer to balance until the attenuation of the bridge is equal to the gain of the amplifier; thus, unity loop gain is achieved, and the temperature is only a few hundredths of a degree below bridge balance temperature.

The oven control amplifier is transistorized and consists of an input amplifier, Q3; a driver amplifier, Q1; and a push-pull, class B power amplifier, Q2 and Q4. This combination delivers about 12 watts to the heater during warmup. When the bridge circuit is subjected to a temperature change, the resistance of the bridge arms changes, causing an unbalance condition. Under this condition, an error signal is derived from the voltage-divider action of the bridge and applied to the base of voltage amplifier Q3. The output of Q3 is taken from the collector, coupled through transformer T2 (which is tuned to approximately 5 kc by C2), and applied to the base of driver amplifier Q1. The collector output of Q1 is applied to transformer T1 which drives the push-pull power amplifier stage, Q2 and Q4. The output power of the power amplifier stage is taken from transformer T3 and applied across the heater bridge circuit causing it to raise the oven temperature which returns the bridge to balance condition. A temperature-controlled avc bias is supplied to Q3 through R20-C18 so that amplifier saturation is reached at relatively small power outputs during periods of high ambient temperature. Thermal switch CB1 removes the short across R6 to provide additional bias when the transistor temperature rises above 65°C (149°F). This provision prevents transistors Q2 and Q4 from being damaged by excessive leakage current.

A number of modifications have been incorporated into the reference oscillator module, and not all modules in the field are necessarily the same. All models are interchangeable, however, as the modifications are internal. The important modifications are discussed here. All modifications are listed on the schematic diagram of the reference oscillator, figure 5-109. MOD J consists of three changes. A Zener diode CR3 has been added to regulate the transistor bias supply to the frequency dividers (to +21 volts), and R29 has been changed in value. These changes eliminate an unstable condition at high temperatures and high power supply voltages. Resistor R40 has been added across inductor L6 to lower the Q of the coil. This change provides more divider bandwidth and improves performance at temperature extremes. MOD G consists of limiting diodes CR1 and CR2 across the oven bridge circuit. These diodes limit the amplitude of the a-c voltage applied to Q3. They are connected in parallel but in opposite polarity from the tie point for components C19, R21, and R22 to the tie point for the oven bridge output lead and the base of Q3. MOD H changed the value of R6 to eliminate oscillation or motorboating of the oven heater circuit when the ambient temperature is above +65°C (+149°F). This oscillation or motorboating will occur at any ambient temperature after the crystal oven has reached its operating temperature if the oven bridge balancing capacitor C20 has been selected improperly. Also repeated temperature cycling causes physical changes in the oven winding, requiring a change in C20 for proper capacitive bridge balance. A resistor, R41, has been added from terminal 3 to terminal 5 of transformer T1 for MOD K. This change prevents motorboating of the oven circuit at very low temperatures. MOD L changed the transistors from 2N128 to 2N499 to increase the reliability at low temperatures. The 2N499 is directly interchangeable with the 2N128 and is preferred when replacing a defective 2N128.

(t) ACCESSORY ISOLATION AMPLIFIER MODULE (AM-1785/GRC). - (See figure 5-110.)

1. 100-KC AMPLIFIER. - The 100-kc frequency standard signal is fed through pin E of connector P1, isolation resistor R1, and coupling capacitor C1 to the control grid, pin 1, of amplifier V1. The plate output signal of V1 is developed in a 100-kc, parallel-tuned circuit consisting of L1, C21, C5, C6, C7, and C8. Variable capacitor C5 is provided for tuning adjustments of the plate tank circuit. Capacitors C6, C7, and C8 form a capacitive-voltage divider. A 100-kc signal is taken from the low-impedance tap at the junction of C7 and C8 and fed to pin F of connector P1 as a 100-kc output. A 100-kc signal is taken from the high-impedance tap at the junction of C6 and C7 and fed to the times six multiplier.

2. MULTIPLIERS. - The isolation amplifier module uses two multipliers, times six multiplier V2 and times four multiplier V3, to obtain a 2.4-mc output from the 100-kc input. The high-impedance output of the 100-kc amplifier, junction of C6 and C7, is directly coupled to the control grid, pin 1, of multiplier V1. This signal drives multiplier V1 into harmonic generation. The plate circuit of multiplier V1, consisting of L2, C11, C12, and C13, is tuned to the sixth harmonic or 600 kc. This 600-kc signal is directly coupled to the control grid, pin 1, of multiplier V2 from the function of C12 and C13. The 600-kc signal drives multiplier V2 into harmonic generation. The plate circuit of multiplier V2, consisting of L3, C15, C16, and C18, is tuned to the fourth harmonic or 2.4 mc. The 2.4-mc signal is taken from the junction of C16 and C17 and fed to pin D of P1 as a 2.4-mc output signal.

(u) 0.1-KC TUNING MODULE. - The 0.1-kc tuning module is used only on Radio Set AN/URC-32B. The module provides the system with a 100-cps incremental tuning capability. The module block diagram is included as part of the frequency generator servicing block diagram figure 4-11. The 0.1-kc tuning module performs a transmit function and a receive function. The two crystal oscillators and diode mixers are used for both the transmit function and the receive function. Separate receive and transmit amplifiers are required to provide the current matching and amplification for the receive and transmit functions.

(v) 0.1-KC TUNING MODULE, TRANSMIT FUNCTION. (See figure 5-111.) - The 300-kc i-f transmit signal from the sideband generator (AM-2064/URC) is applied through P1-A2 to a resistive divider consisting of R29 and R30. The voltage developed across R29 is coupled through C16 and T1 to a mixer consisting of CR3 through CR6 and T2. An oscillator injection frequency from Q4, selectable in 0.1-kc steps from 212.1 to 213.0 kc, is applied to the center tap of T2. The output of the mixer is fed to a second mixer through a filter circuit which is tuned to 513 kc. The filter circuit consists of C6 through C10, L1, R36, and the windings of T2 and T3. The second mixer circuit (CR7 through CR10 and T3) receives a 213.0-kc oscillator injection signal from amplifier Q6. The output of the second mixer is amplified by Q1 and Q7 and applied through P1-A4 to the r-f tuner module.

Transmit amplifier Q1 is gated off during receive operation. When the key line is open, diode CR11 is reverse biased and the bias voltage of Q1 rises to approximately +9 volts (voltage divider R5 and R6) which biases Q1 to cutoff. When the 130-volt d-c transmit is applied to the key line, relay K1 operates such that CR11 is forward biased connecting R34 in parallel with R5. This reduces the Q1 base voltage to approximately +3 volts which biases Q1 on.

Oscillators Q5 and Q3 provide injection signals for the two mixers of the 0.1-kc tuning module. Oscillator Q5 frequency remains fixed at 213.0 kc and is controlled by crystal Y10. The frequency of oscillator Q3 is determined by selecting the desired crystal, Y1 through Y9, or selecting the 213.0-kc output of Q5. This frequency selection provides a first mixer output sum frequency between 513.0 (213.0-kc oscillator injection) and 512.1 kc (212.1-kc oscillator injection). When this signal is mixed with the fixed 213.0-kc oscillator injection signal in the second mixer, the resultant difference frequency is between 299.1 and 300.0 kc. The 0.1-kc step selection of oscillator Q3 frequencies then provides 0.1-kc step selection of the transmit i-f frequencies.

(w) 0.1-KC TUNING MODULE, RECEIVE FUNCTION. (See figure 5-111.) - The operation of the 0.1-kc tuning module for the receive function is basically the same as for the transmit function discussed in paragraph (v). The 300-kc i-f receive signal from the r-f tuner module is applied through P1-A3 and C43 to gating diode CR12. In the transmit mode of operation 130-volt d-c transmit is applied to the transmit key-line relay which reverse biases CR12 and no receive signal is passed by the gate. When the 130-volt d-c transmit is removed from the transmit key-line relay, gating diode CR12 is forward biased and the receive signal is applied through filter FL1 to a mixer circuit consisting of CR7 through CR10 and T3. A fixed 213.0-kc injection signal is also applied to the mixer from amplifier Q6. The output of the mixer is fed to a second mixer through a filter circuit which is tuned to 513 kc. This filter circuit consists of C6 through C10, L1, R36, and the windings of T2 and T3. The second mixer circuit (CR3 through CR6 and T2) receives an injection signal from amplifier Q4 which can be selected in 0.1-kc steps from 212.1 to 213.0 kc. This frequency selection provides a mixer output difference frequency between 300 kc (213.0-kc injection) and 299.1 (212.1-kc injection). The output of the second mixer is coupled through T1 to receive output amplifier Q2. During the transmit mode of operation, diode CR1 is forward biased and amplifier Q2 is biased to cutoff by reducing the voltage at the emitter. When the 130-volt d-c transmit is removed from the transmit key line, diode CR1 is reverse biased and the emitter voltage rises to the operating level, gating Q2 on. The receive i-f signal is then coupled through C13 and P1-A1 to the sideband generator (AM-2064/URC).

(x) CHASSIS CIRCUITS. - Refer to schematic diagram figure 5-101. The chassis includes all module interconnections, metering circuits, and control circuits. Switch S1 is the band selector switch and operates sidestep oscillator bypass relay K1. Relay K1 bypasses the sidestep oscillator on BAND 1, BAND 2, BAND 3 ADD 0, and BAND 4 ADD 0. AFC meter M1 provides a front panel indication of the master oscillator frequency correction by the stabilized master oscillator stabilizing loop.

d. AMPLIFIER-CONVERTER MODULATOR AM-2064/URC. - Amplifier-Converter-Modulator AM-2064/URC (sideband generator) translates audio frequencies to intermediate frequencies during transmit conditions, and intermediate frequencies to audio frequencies during receive conditions. During transmit operation, the audio inputs from an external audio and control unit are fed to a balanced modulator module. The balanced modulator module contains two 300-kc balanced modulators. One balanced modulator is followed with an upper-sideband filter and the other is followed with a lower-sideband filter. The two output signals are fed to the transmit gain control (tgc) where the amplitude of the output signal is controlled by a tgc voltage from an external power amplifier. During receive operation, the 300-kc i-f input signal from an external tuner is fed to i-f amplifier-detector modules.

The sideband generator consists of a main chassis and plug-in modules. The modules required for operation of the sideband generator depend upon the desired mode of operation. The following is a list of the modules that can be used in the sideband generator and mode of operation for which the module is required:

MODULE NAME	OPERATION
Carrier generator	Transmit and receive
Balanced modulator	Transmit
Tgc	Transmit without vox

MODULE NAME	OPERATION
Tgc-vox antivox Not supplied with AN/URC-32( ))	Transmit with vox
LSB i-f/a-f amplifier	LSB receive
USB i-f/a-f amplifier	USB receive
AM i-f/a-f amplifier	AM receive

If the balanced modulator module is not used, it is replaced with a dummy plug to provide proper loading for the carrier generator module and closes the chassis air hole. When other modules are not used, they are replaced with a dummy plate to close the chassis air hole.

This paragraph contains a general description of the transmit operation. Refer to figure 4-21. The balanced modulator, carrier generator, and TGC modules operate during transmit condition to translate audio input frequencies to 300-kc i-f output frequencies. Audio transformers T4 and T3 couple upper-sideband and lower-sideband audio inputs to the balanced modulator module which modulates a 300-kc carrier to produce separate and distinct upper- and lower-sideband signals with the carrier suppressed. The 300-kc carrier is produced in the carrier generator module by tripling the 100-kc reference oscillator signal from the frequency generator. The outputs of the balanced modulator module are connected in parallel to the TGC module. The TGC module, controlled by tgc voltage fed back from the power amplifier unit, maintains the 300-kc i-f output voltage at a sufficiently low level to prevent overdriving any following stages. On AM operation, a 300-kc carrier injection signal from the carrier generator module is fed to the 300-kc i-f output. In the ON position, the sidetone switch feeds a portion of the transmit audio to the receive audio circuits.

A general description of the receive operation is given in this paragraph. The i-f/a-f amplifier modules (LSB, USB, and AM) operate only during receive condition to amplify the 300-kc i-f signal from the r-f tuner, demodulate the signal, and amplify the detected audio. A 300-kc carrier is reinserted into the LSB and USB i-f/a-f amplifier modules from the carrier generator module. When the front panel SSB-AM switch is in the AM position, the LSB and USB i-f/a-f amplifier modules and the carrier generator module (AM receive only) are disabled. The audio output from the AM i-f/a-f amplifier module is switched to the USB lines when the SSB-AM switch is in the AM position. The AM i-f/a-f amplifier module is disabled when the SSB-AM switch is in the SSB position.

(1) FUNCTIONAL TEST DATA. - The following information provides over-all functional test data and equipment required for the sideband generator unit.

(a) DETERMINING OVER-ALL PERFORMANCE. - The operation of the sideband generator depends upon other units of the system. Refer to section 3 for the operational checks of this unit. Refer to servicing block diagram figure 4-21. If the operational checks indicate the sideband generator is malfunctioning, isolate the trouble to a defective module. Replace the defective module or isolate the trouble to a defective component in the module. Conventional trouble-shooting procedures can be used to locate a defective component with the aid of the sideband generator module schematic diagrams figures 5-113, 5-114, 5-115, 5-116, 5-117, and 5-118 with the associated voltage and resistance charts. All measurements are taken from terminal to ground with a vtvm (ME-26A/U). All resistance measurements are taken with the module removed from the chassis. All voltages are taken with the module plugged into the chassis or connected to the chassis with pendant cables operating with no audio or i-f signal inputs.

Table 4-6 lists the test-point voltages for locating a defective module using signal-tracing procedures. A set of test points is listed for each mode of operation. For example, if trouble is suspected on USB transmit operation, use the test points listed for the USB transmit mode of operation to locate the defective module. Test-point voltages are taken with the sideband generator installed in an operating system and with proper injection signals applied. All a-c voltages are taken with vtvm (AN/USM-143) and all d-c voltages are taken with a vtvm (ME-26A/U).

In transmit operation the power amplifier is turned off, and the EXCITER RF GAIN control is adjusted to prevent overdriving the power amplifier input circuit. For both USB and LSB transmit modes of operation, inject a 1000-cps signal at the remote audio input connector, J7, on the back of the audio and control unit, and adjust the microphone gain control to obtain a reading of one volt at A2J2 on the balanced modulator module. A 1000-cps injection signal can be obtained from Interconnecting Box J-1007/U at TBA7 and TBA8.

In receive operation the RECEIVER RF GAIN control is set in the maximum clockwise position. For the three receive modes of operation, inject the proper i-f signal at J8 on the frequency generator chassis, and adjust the level to the value specified in table 4-6.

(b) EQUIPMENT AND TOOLS REQUIRED FOR FUNCTIONAL TESTING. - The test equipment and tools required for testing on the over-all functional level are listed in table 4-7.

(c) ADJUSTMENTS AND ALIGNMENTS. - The adjustments and alignments necessary for proper operation of the sideband generator are as follows: carrier generator alignment (paragraph 5-2b(3)(a)), carrier balance adjustment of balanced modulator module (paragraph 5-2b(3)(b)), USB i-f/a-f amplifier module alignment (paragraph 5-2b(3)(c)), LSB i-f/a-f amplifier module alignment (paragraph 5-2b(3)(d)), AM i-f/a-f amplifier module alignment (paragraph 5-2b(3)(e)), carrier reinsert adjustment (paragraph 5-2b(3)(f)), meter balance adjustment (paragraph 5-2b(3)(g)), LSB and USB audio gain adjustments (paragraph 5-2b(3)(h)), and TGC amplifier alignment (paragraph 5-2b(3)(i)).

TABLE 4-6. SIDEBAND GENERATOR MODULE TROUBLE ISOLATION, TEST-POINT VOLTAGES

MODE OF OPERATION AND INJECTION SIGNAL	TEST POINT	TEST-POINT LOCATION	FREQUENCY	NORMAL SIGNAL	IF SIGNAL IS ABNORMAL
Tune	J3	Carrier generator	300 kc	25 mv	Defective carrier generator module.
USB or AM transmit: Adjust injection signal for 1 volt at balanced modulator A1J2	A1J2	Balanced modulator	1000 cps	1.0 volt	Adjust injection signal.
	A1J1	Balanced modulator	300 kc	2.3 volts	Defective carrier generator module.
	A1J1	TGC	299 kc	5.5 mv	Defective balanced modulator module.
	A1J2	TGC	299 kc	35 mv	Defective TGC module.
LSB transmit: Adjust injection signal for 1 volt at balanced modulator A2J2	A2J2	Balanced modulator	1000 cps	1.0 volt	Adjust injection signal.
	A2J1	Balanced modulator	300 kc	2.3 volts	Defective carrier generator module.
	A1J1	TGC	301 kc	5.5 mv	Defective balanced modulator module.
	A1J2	TGC	301 kc	35 mv	Defective TGC module.
USB Receive: Adjust injection signal for 100 uv at chassis J8	J8	Chassis	299 kc	100 uv	Adjust injection signal.
	J2	Carrier generator	300 kc	19 volts	Defective carrier generator module.
	J1	USB i-f/a-f amplifier	1000 cps	1.6 volts	Defective USB i-f/a-f amplifier module.
	J2	USB i-f/a-f amplifier	Agc (d-c)	-1.0 volt	Defective USB i-f/a-f amplifier module.
	J1	Carrier generator	300 kc	30 volts	Defective carrier generator.
LSB Receive: Adjust injection signal for 100 uv at chassis J8	J8	Chassis	301 kc	100 uv	Adjust injection signal.
	J2	Carrier generator	300 kc	19 volts	Defective carrier generator module.
	J1	LSB i-f/a-f amplifier	1000 cps	1.6 volts	Defective LSB i-f/a-f amplifier module.
	J2	LSB i-f/a-f amplifier	Agc (d-c)	-1.0 volt	Defective LSB i-f/a-f amplifier module.
	J1	Carrier generator	300 kc	30 volts	Defective carrier generator.
AM Receive: Adjust injection signal for 100 uv, 30 percent modulated at 1000 cps at chassis J8	J8	Chassis	300 kc	100 uv	Adjust injection signal.
	J2	Carrier generator	300 kc	0 volt	Chassis relay K2 defective.
	J1	AM i-f/a-f amplifier	1000 cps	1.6 volts	Defective AM i-f/a-f amplifier module.
	J2	AM i-f/a-f amplifier	Agc (d-c)	-1.0 volt	Defective AM i-f/a-f amplifier module.

TABLE 4-7. TEST EQUIPMENT FOR FUNCTIONAL TESTING OF AMPLIFIER-CONVERTER-MODULATOR AM-2064/URC

QTY	EQUIPMENT	MODEL	MFR	CHARACTERISTICS
1	Electronic Voltmeter	ME-26A/U	Hewlett-Packard	Voltage range: 0 to 300 volts ac in 6 scales 0 to 1000 volts dc in 7 scales Frequency range: 20 cps to 700 mc. (Cont)

TABLE 4-7. (Continued)

QTY	EQUIPMENT	MODEL	MFR	CHARACTERISTICS
	Electronic Voltmeter (Cont)			(Cont) Accuracy: ±3 percent. A-c input impedance: 10 megohms. D-c input impedance: 122 megohms. Ohmmeter range: 10 ohms to 10 megohms in 7 ranges.
1	Audio Oscillator	TS-382/U	Hewlett-Packard	Frequency range: 20 cps to 200 kc in 4 bands. Frequency response: 10 volts into 1000 ohm load; 400-cps reference; 20 cps ±1 db and 150 kc. Frequency accuracy: 6 percent. Frequency stability: 2 percent.
1	R-F Signal Generator	AN/URM-25	Speciality Engineering and Electric	Frequency range: 10 kc to 50 mc. Output voltage: 0.1 uv to 0.1 volts, continuously variable (2.0 volts open circuit). Output impedance: 50 ohms
1	Communications Receiver	R-390/URR	Collins	Frequency range: 0.5 to 32 mc. Capability: receives CW, SSB, AM. Tuning: Continuous direct-reading frequency on dial. Calibration: Crystal every 100 kc. Selectivity: 100-cps to 16 kc in 6 steps.
1	Electronic Voltmeter	AN/USM-143	Hewlett-Packard	Voltage range: 1.0 mv to 300 volts in 12 scales. Frequency range: 10 cps to 4 mc. Accuracy: ±3 percent. Input impedance: 10 megohms.

(2) DETAILED CIRCUIT DESCRIPTION. - The detailed circuit description of this unit is discussed on a module basis. Refer to the servicing block diagram of the unit figure 4-21. In addition, appropriate references are made to the module schematic diagrams.

(a) BALANCED MODULATOR MODULE. - Refer to schematic diagram figure 5-113. The balanced modulator module includes two balanced modulators which are identical except for the bandpass characteristic of their individual mechanical filters. Two separate audio inputs are provided to the module, one to the upper-sideband balanced modulator section and one to the lower-sideband balanced modulator section. This provision allows the audio input signal to be switched to either or both input connections so that the output may be upper sideband, lower sideband, or twin sideband of the suppressed carrier. Since the action of both balanced modulators is identical, the following paragraph describes the operation of only the upper-sideband balanced modulator section.

Note

> The two balanced modulators are called upper- and lower-sideband modulators because of the frequency relationship between the final transmitted sideband signal and the suppressed carrier. Due to a sideband inversion in the r-f tuner, the upper-sideband balanced modulator produces a 297- to 300-kc signal and the lower-sideband balanced modulator produces 300- to 303-kc signal.

Approximately 1.0 volt rms audio input signal is introduced into the balanced modulator module through receptacle A1P1. This signal is applied to a 2-to-1 stepup impedance-matching transformer A1T1. Filters A1C1-A1L1 and A1C2-A1L2 isolate the injected carrier signal from the audio circuits. The audio signal from the two secondary windings of T1 is coupled through two separate resistive pads and applied across a germanium diode bridge circuit, A1CR1. The resistive pads match the impedance of T1 to that of A1CR1 and attenuate the signal approximately 20 db to produce a 1-to-10 audio-to-carrier-level ratio at the diode bridge circuit. This ratio prevents the audio signal from initiating diode conduction in the bridge. The 300-kilocycle r-f carrier is injected through isolation resistors A1R9 and A1R10 to two diode balance potentiometers, A1R7 and A1R8. These potentiometers balance the diode bridge so that no carrier frequency is coupled into the output signal. With no audio signal input, there is no output across the bridge circuit load A1R11 and A1R12. The r-f carrier applied to the bridge causes the diode pairs to conduct on alternate half-cycles, which produces outputs across the circuit load that are equal in amplitude and opposite in phase. This results in r-f carrier suppression. When an audio signal is introduced across the bridge circuit, the r-f carrier, acting as a high-frequency switch, causes the diode-pairs to conduct on alternate half-cycles of the carrier frequency. This action switches the audio at the carrier switching frequency and produces a modulated output signal containing the sum and difference frequencies that constitute the upper and lower sidebands of the suppressed carrier frequency. This type of balanced modulator provides approximately 45-db suppression of the carrier frequency at the bridge output. The double-sideband suppressed-carrier output signal appears across load resistors A1R11 and A1R12 and is coupled through capacitors A1C3 and A1C4 to mechanical filter FL1. Due to the bandpass characteristics of FL1, the r-f carrier is suppressed an additional 20 db, and the unwanted sideband is suppressed 60 db. The single-sideband suppressed-carrier signal output of FL1 is applied to impedance-matching resistors A1R13 and A1R14. Outputs available are upper sideband, lower sideband, or both sidebands. When a single-sideband mode is selected, the selected signal is taken directly from the filter associated with the particular balanced modulator section. Although there is another mode of operation (AM), it is not produced until the 300-kc carrier is reinserted at the output of the sideband generator. The output of either balanced modulator section of the module is approximately 5.0 mv.

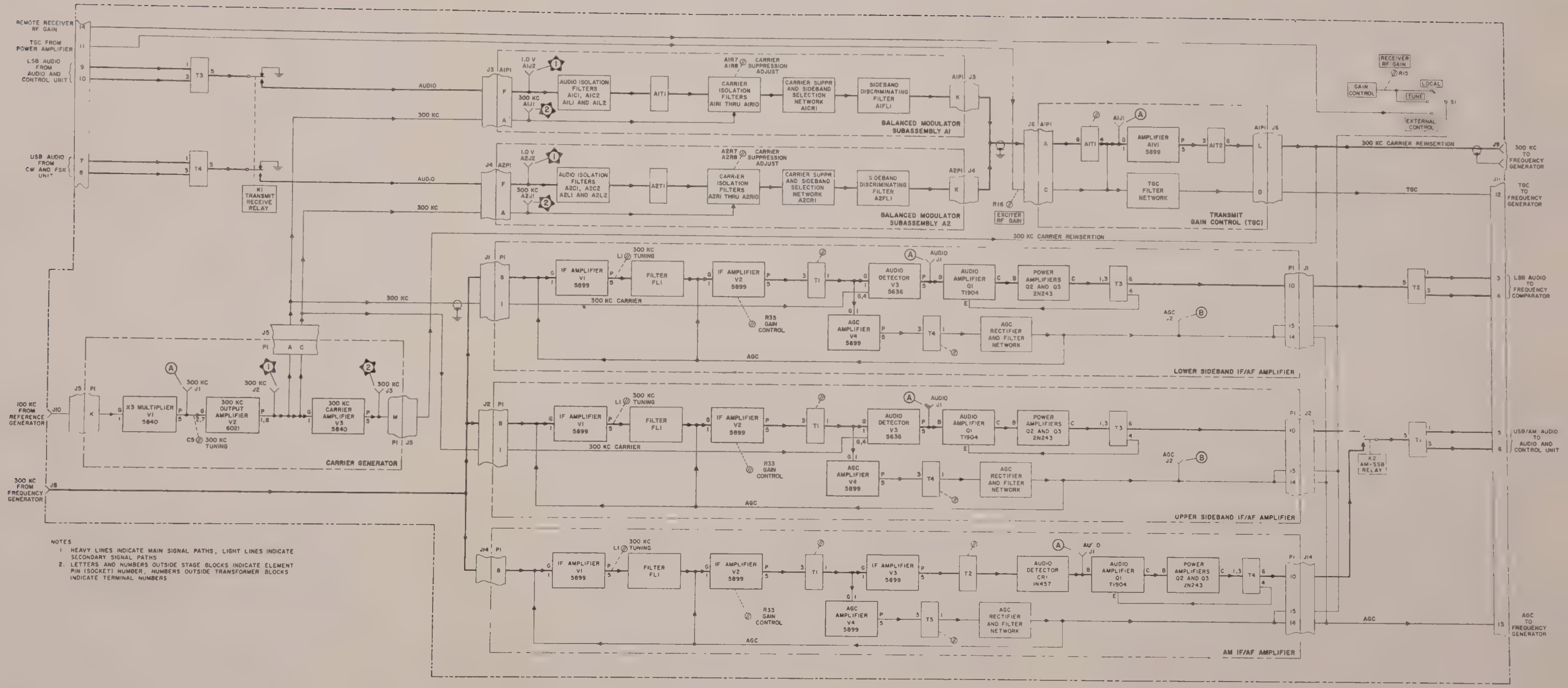
(b) CARRIER GENERATOR MODULE. - Refer to schematic diagram figure 5-114. The carrier generator module triples the 100-kc signal from the 100-kc reference oscillator to produce the 300-kc signal necessary for r-f carrier insertion to the balanced modulator module during the transmit condition, and for carrier reinsertion to the USB or LSB i-f/a-f amplifiers during receive condition. During the receive condition, the 300-kc output of the carrier generator module is used by the product detectors of the i-f/a-f amplifier modules to demodulate the i-f single-sideband signal. The 300-kc output from the carrier generator module has the same stability as that of the reference oscillator.

The 100-kc input signal to the carrier generator module is introduced through terminal K of receptacle P1, coupled through capacitor C1, and impressed on the control grid of multiplier V1. Multiplier V1 is a 5840A pentode with its plate tank circuit tuned to 300-kc. Application of the 100-kc voltage on the control grid causes a 300-kc component to be delivered to the plate circuit, where it is developed across the plate tank circuit consisting of L1, C3, C4, and C5. Thus, the input frequency is tripled to produce an output of 300-kc. Variable capacitor C5 permits tuning the tank circuit frequency. The output of the multiplier stage is taken from a capacitive voltage divider and applied to the control grid of output amplifier V2. Amplifier V2 is a 6012A dual triode which is operated with both triode sections in parallel. This type of operation provides a high transconductance with a consequent decrease in plate resistance, permitting higher gain and lower output impedance. Two separate 300-kc outputs are taken from the plate of V2. One output is coupled through capacitor C11 and applied to terminal A of receptacle P1, while the other output is coupled through capacitor C12 and applied to terminal C of receptacle P1. These two 300-kc signals are used as the carrier frequencies for the balanced modulator module when transmitting, and as carrier insertion in the USB and LSB i-f/a-f amplifier modules when receiving.

An additional output from output amplifier V2 is coupled through C8 to the grid of carrier amplifier V3, which supplies a carrier reinsertion signal for AM operation or tuning. A ground is placed on the cathode of the carrier amplifier circuit when the AM-SSB switch (S4 on the chassis) is in the AM position or the TUNE-LOCAL-EXTERNAL CONTROL switch (S1 on the chassis) is in the TUNE position. The output of carrier amplifier V3 is controlled by a bias voltage applied to the grid by carrier reinsert adjust control R3 on the chassis. This control is adjusted to provide a carrier reinsertion signal equal in power to the sideband signal. The 300-kc carrier reinsert signal from the plate of carrier amplifier V3 is coupled through C15 to the 300-kc i-f output jack, J9, on the chassis of the sideband generator.

(c) TGC MODULE. - Refer to schematic diagram figure 5-115. The tgc (transmit gain control) module automatically adjusts the amount of signal delivered to the r-f tuner and to the power amplifier. It ensures that the power amplifier stage is operating near its maximum power capability, but that it is not being overdriven. This action is accomplished by controlling the gain of a tgc amplifier. The signal from the balanced modulator module is coupled through input transformer T1 and capacitor C2 to the control grid of tgc amplifier V1. The control of the tgc amplifier gain is accomplished in the following manner. Sampling-circuits in the power amplifier circuit derive a d-c voltage whenever there is power amplifier grid current or when the r-f output exceeds a nominal setting of 500 watts. This negative voltage is fed back to the control grid of the tgc amplifier through resistor R1, which reduces the gain of the tgc amplifier. The action is similar to avc (automatic volume control) in audio applications. Capacitors C4 and C6 in the feedback line set the attack and release times of the tgc circuitry. A reduced tgc output is taken at the junction of C4-R2 and C6-R3 and is fed to the r-f tuner as tgc voltages for long-time constant control of the transmit i-f amplifiers.

(d) LSB I-F/A-F AMPLIFIER MODULE. - Refer to schematic diagram figure 5-116. The LSB i-f/a-f amplifier module amplifies the i-f signal and recovers and amplifies the a-f signal. The signal containing the 300-kc sideband intelligence is coupled through capacitor C1 to the control grid of the first i-f amplifier, V1, through gain control R1. The output of V1 is taken from the tuned plate circuit, L1-C5, and coupled through capacitor C6 to mechanical filter FL1. Due to a frequency inversion in the r-f tuner, filter FL1 passes a band of frequencies from 300 to 303 kc, passing only the received lower sideband of the 300-kc i-f signal. The output from FL1 is coupled through C8 and applied to the control grid of the second i-f amplifier, V2. R33 in the cathode circuit of V2 provides a manual gain control for setting desired gain of the module. The amplified output of V2 is coupled through i-f transformer T1 and applied to the control grid of detector V3. Detector V3 is a beat-type or product detector in which a 300-kc carrier signal from the carrier generator module is mixed with the 300- to 303-kc lower-sideband i-f signal. The difference frequencies (0 to 3 kc) are recovered as audio intelligence. The 300-kc carrier is obtained from the carrier generator module and introduced into the LSB i-f/a-f amplifier module through terminal 1 of receptacle P1. The carrier signal then is coupled through capacitor C12 and applied to the suppressor grid of detector V3. The a-f signal recovered from the beating action is coupled from the plate of V3 through a low-pass filter consisting of L2, C15, and C14, and the filter passes only the audio signal. This demodulated audio signal is coupled through C17 and C18 to the base of transistor a-f amplifier Q1. The collector output of Q1 appears across the primary winding of coupling transformer T2. The signal from the secondary winding of T2 drives a push-pull, class AB_2, a-f power amplifier consisting of transistors Q2 and Q3. Transformer T3 couples audio signal from the collectors of Q2 and Q3 through terminals 10 and 11 of receptacle P1 to external audio monitoring devices when output from this subassembly is selected. The small transformers used in the audio stages are subject to saturation at low frequencies with consequent attenuation of the low frequencies. To compensate for this attenuation, negative feedback from a separate secondary winding of transformer T3 is connected to the emitter of Q1. The negative feedback reduces the gain of the stages slightly but improves the low-frequency response. The output level of the lower sideband i-f/a-f amplifier module is approximately 20 milliwatts into a 150-ohm load. C30 prevents transistors Q2 and Q3 from breaking into parisitic oscillation. An amplifier agc (automatic gain control) system is employed in the lower sideband i-f/a-f amplifier to maintain a nearly constant level. The agc voltage is derived by taking a portion of the i-f signal from the secondary winding of T1, amplifying it with the agc amplifier, V4, rectifying it with crystal diode CR2, and applying the resultant negative voltage as bias to the control grids of i-f amplifiers V1 and V2. The i-f signal from the secondary winding of T1 is direct coupled to the control grid of agc amplifier V4. The amplified output of V4 is coupled through transformer T4 to crystal diode CR2, which rectifies the signal. Voltage-divider network R27, R28, and R29 develops a positive voltage to back bias the rectifier diode CR2. Consequently, the agc voltage is delayed until signal strength has increased sufficiently; low-level signals are not attenuated by agc. The rectified voltage taken from CR2 is filtered by a network consisting of C23, C24, C25, R25, and R26. The filtered, negative d-c voltage is applied through R5 and the output winding of FL1 to the control grid of V2, and through R2 and R1 to the control grid of V1. The agc voltage controls the gain of these stages by applying the most negative bias during the arrival of excessively strong signals. The agc voltage is applied through gating diode CR1 to pin 14 of P1 for application to the r-f tuner and the metering circuit


REMOTE RECEIVER RF GAIN
TGC FROM POWER AMPLIFIER
LSB AUDIO FROM AUDIO AND CONTROL UNIT
USB AUDIO FROM CW AND FSK UNIT
T3
T4
K1 TRANSMIT RECEIVE RELAY
AUDIO
300 KC
J3 A1P1
1.0 V A1J2
300 KC A1J1
AUDIO ISOLATION FILTERS A1C1, A1C2 A1L1 AND A1L2
A1T1
A1R7 A1R8 CARRIER SUPPRESSION ADJUST
CARRIER ISOLATION FILTERS A1R1 THRU A1R10
CARRIER SUPPR AND SIDEBAND SELECTION NETWORK A1CR1
SIDEBAND DISCRIMINATING FILTER A1FL1
BALANCED MODULATOR SUBASSEMBLY A1
J4 A2P1
1.0 V A2J2
300 KC A2J1
AUDIO ISOLATION FILTERS A2C1, A2C2 A2L1 AND A2L2
A2T1
A2R7 A2R8 CARRIER SUPPRESSION ADJUST
CARRIER ISOLATION FILTERS A2R1 THRU A2R10
CARRIER SUPPR AND SIDEBAND SELECTION NETWORK A2CR1
SIDEBAND DISCRIMINATING FILTER A2FL1
BALANCED MODULATOR SUBASSEMBLY A2
R16 EXCITER RF GAIN
J6 A1P1
A1T1
A1J1
AMPLIFIER A1V1 5899
A1T2
TGC FILTER NETWORK
TRANSMIT GAIN CONTROL (TGC)
RECEIVER RF GAIN
R15
GAIN CONTROL
LOCAL
TUNE
S1
EXTERNAL CONTROL
300 KC CARRIER REINSERTION
J9
300 KC TO FREQUENCY GENERATOR
TGC
J11
TGC TO FREQUENCY GENERATOR
J1 P1
L1 300 KC TUNING
IF AMPLIFIER V1 5899
FILTER FL1
IF AMPLIFIER V2 5899
300 KC CARRIER
R35 GAIN CONTROL
T1
AUDIO DETECTOR V3 5636
AUDIO J1
AUDIO AMPLIFIER Q1 T1904
POWER AMPLIFIERS Q2 AND Q3 2N243
T3
AGC AMPLIFIER V4 5899
T4
AGC RECTIFIER AND FILTER NETWORK
AGC
AGC J2
LOWER SIDEBAND IF/AF AMPLIFIER
P1 J1
T2
LSB AUDIO TO FREQUENCY COMPARATOR
J2 P1
R33 GAIN CONTROL
UPPER SIDEBAND IF/AF AMPLIFIER
P1 J2
K2 AM-SSB RELAY
T1
USB/AM AUDIO TO AUDIO AND CONTROL UNIT
J5 P1
100 KC FROM REFERENCE GENERATOR
J10
X3 MULTIPLIER V1 5840
300 KC J1
300 KC OUTPUT AMPLIFIER V2 6021
C5 300 KC TUNING
300 KC J2
300 KC CARRIER AMPLIFIER V3 5840
300 KC J3
CARRIER GENERATOR
300 KC FROM FREQUENCY GENERATOR
J8
J14 P1
IF AMPLIFIER V3 5899
T2
AUDIO DETECTOR CR1 1N457
T4
T5
AM IF/AF AMPLIFIER
P1 J14
AGC TO FREQUENCY GENERATOR

NOTES
1 HEAVY LINES INDICATE MAIN SIGNAL PATHS, LIGHT LINES INDICATE SECONDARY SIGNAL PATHS
2. LETTERS AND NUMBERS OUTSIDE STAGE BLOCKS INDICATE ELEMENT PIN (SOCKET) NUMBER, NUMBERS OUTSIDE TRANSFORMER BLOCKS INDICATE TERMINAL NUMBERS

Figure 4-21. Amplifier-Converter-Modulator AM-2064/URC, Servicing Block Diagram

of the generator chassis. Gating diode CR1 prevents agc interaction between the LSB i-f/a-f amplifier and the USB i-f/a-f amplifier modules, since the agc circuits are connected in parallel at the outputs. The agc filter of the LSB i-f/a-f amplifier module is a double time-constant filter, one section is of short duration and the other of long duration. This provision is necessary to compensate for lack of an r-f carrier in the single-sideband signal. The characteristics of single-sideband operation cause voice intelligence to be transmitted in groups of r-f energy since no r-f carrier is present. Consequently, an agc action is necessary to maintain a nearly constant operating gain of the i-f amplifiers between groups of intelligence. At the same time, agc action on the average level within the speech groups is necessary. This is accomplished by the double time-constant agc filter. The portion of the filter consisting of C24 and R26 is effective primarily between speech groups. This filter, C24-R26, provides fast attack and very slow release characteristics. The agc circuit of the LSB i-f/a-f amplifier module will limit the output of this subassembly to a maximum of 8-db rise for approximately an 80-db rise of input. Combined with the agc control in the r-f tuner, the agc circuit will limit the LSB i-f/a-f amplifier module output to an 8-db rise for a 100-db rise of signal at the antenna.

(e) USB I-F/A-F AMPLIFIER MODULE. - Refer to schematic diagram figure 5-116. Since the USB i-f/a-f amplifier module differs from the LSB i-f/a-f amplifier module only in the bandpass characteristics of its mechanical filter, refer to paragraph (d) for circuit description. Due to a frequency inversion in the r-f tuner, mechanical filter FL1, of the USB i-f/a-f amplifier module has a pass band of 297 to 300 kc so that it passes only the received upper sideband of the 300-kc i-f signal.

(f) AM I-F/A-F AMPLIFIER MODULE. - Refer to schematic diagram figure 5-117. The AM i-f/a-f amplifier module provides for reception of amplitude modulated (AM) signals. The first two stages of i-f amplification are identical with the first two stages of the LSB i-f/a-f amplifier module except for the pass bands of their respective filters. The mechanical filter of the AM i-f/a-f amplifier module has a 6-kc pass band to accommodate a double-sideband (with carrier) AM signal, while the mechanical filters of the USB and LSB i-f/a-f amplifier modules each have a 3-kc pass band for single-sideband suppressed carrier signals. An additional i-f amplifier stage provides the higher gain needed in the AM module for diode detection. The output of the third i-f amplifier is applied to a conventional AM diode detector, CR1. The audio signal from the diode detector is applied to the a-f amplifier stages, which are identical to the a-f circuits used in the single-sideband i-f/a-f amplifier modules.

The i-f input signal is fed into the module through terminal 8 of receptacle P1. The signal from P1-8 is coupled through capacitor C27 and r-f gain control R1 to the control grid of the first i-f amplifier, V1. The amplified output of V1 is coupled from a parallel-tuned circuit, consisting of L1 and C5, through capacitor C4 to mechanical filter FL1. The output of FL1 is applied to the control grid of the second i-f amplifier, V2. The output of V2 is coupled through i-f transformer T1 to the control grid of the third i-f amplifier, V3. The plate output of V3 is coupled through i-f transformer T2 to crystal diode detector CR1 and its filter network, which passes only the recovered audio signal. The audio signal is coupled through capacitor C16 to the audio amplifier stages, which are identical to those discussed in paragraph (d). The agc circuits also operate identically to those discussed in paragraph (d), except for a shorter time constant. The difference in time constants is due to the fact that no transmitted carrier is available in the single-sideband modules. The i-f gain controls in the cathode circuit of V2 of the two sideband i-f/a-f amplifier modules, and in the AM i-f/a-f amplifier module, are provided to permit balancing of i-f gain of the two units in use so that uniform output from the i-f stages are obtained.

(g) TGC-VOX ANTI-VOX MODULE (NOT SUPPLIED WITH AN/URC-32( )). - Refer to schematic diagram figure 5-118. When vox (voice operate control) is desired, the tgc module is replaced with the tgc-vox anti-vox module. The tgc section of this module is the same as the tgc module. The vox (voice operate control) section of the tgc-vox anti-vox module automatically keys the transmitter whenever a predetermined level of input signal appears on the audio input line. An antivox circuit is incorporated to prevent the transmitter from being keyed by feedback from the receiver speaker. The audio input of the sideband generator is taken from the secondary of transformers T3 and T4 on the chassis and coupled to the vox amplifier, Q1, through transformer T1. Potentiometer R16 provides a vox threshold level adjustment. The output of the vox amplifier is rectified by voltage-doubler circuits CR1 and CR2, and the positive voltage is amplified by d-c amplifiers Q3 and Q4 to operate relay K1. Thermistor RT1 compensates for the leakage current change in Q3 by decreasing in resistance as the temperature increases. The antivox amplifier is similar to the vox amplifier. The receiver audio output is coupled through transformer T2. Potentiometer R17 provides an antivox level adjustment. The output of the antivox amplifier is rectified by CR3 and CR4, and the negative voltage is applied to the d-c amplifiers to cancel the positive vox voltage.

(h) CHASSIS CIRCUITS. - Refer to schematic diagram figure 5-112. The chassis includes all module interconnections, metering circuits, and the control circuits. Individual a-f gain controls R1 and R2 permit balancing the audio outputs of the USB and LSB i-f/a-f amplifier modules. Transmit-receive relay K1 is the primary keying relay for the AN/URC-32( ).

e. CONVERTER-MONITOR CV-730/URC. - Converter-Monitor CV-730/URC (CW and FSK unit) enables a single-sideband suppressed carrier transceiver to be operated in CW and FSK mode of operation. On FSK transmit operation, the CW and FSK Unit converts the keying input from a teletypewriter current loop to audio tones, 1575 cps for space (no loop current) and 2425 cps for mark (loop current).

The FSK keying input is high impedance. With a teletypewriter operating on a standard loop current, an external resistor of 800 ohms or larger should be placed across the signal line to permit the 20-, 30-, or 60-ma loop current to develop a positive voltage pulse of 25 to 50 volts at the input terminal. On CW transmit operation, the unit provides a keyed audio tone of 1000 cps or 1500 cps, selected by front panel switch. On FSK receive operation, the CW and FSK unit provides a bfo output signal. This signal is centered on 300.550 kc and is variable approximately 1 kc above or below this frequency. The CW and FSK unit also has a relay circuit for break-in CW operation and a metering circuit for monitoring the receive and transmit audio outputs of the audio and control unit, in addition to monitoring the output of the CW and FSK unit.

(1) FUNCTIONAL TEST DATA. - The following information provides over-all functional test data and equipment required for the sideband generator unit.

(a) DETERMINING OVER-ALL PERFORMANCE. - When the CW and FSK unit does not operate properly, as indicated by system trouble isolation, refer to servicing block diagram figure 4-22 and isolate the trouble to a functional section. Faulty transmitter operation on CW and FSK modes of operation indicates trouble in the oscillator-buffer-amplifier circuit. The transmitter outputs of the CW and FSK unit can be monitored on the CW and FSK unit meter with the meter switch in the USB XMIT position. The frequency of the oscillator-buffer-amplifier circuit is fixed on CW operation and no provision is made for adjustment. On FSK operation, frequency adjustments are provided for both mark and space frequencies. If the system is not keyed to transmit properly on CW operation, the trouble may be in the CW break-in relay circuit. Improper CW and FSK receiver operation indicates trouble in the bfo circuit. Once the trouble has been isolated to a functional circuit, standard trouble isolation methods with the aid of the schematic diagram, figure 5-119 and the voltage and resistance measurements can be used to locate the faulty part.

(b) EQUIPMENT AND TOOLS REQUIRED FOR FUNCTIONAL TESTING. - The test equipment and tools required for testing on the over-all functional level are listed in table 4-8.

(c) ADJUSTMENTS AND ALIGNMENTS. - The adjustments and alignments necessary for proper operation of the CW and FSK unit are as follows: The keying release time adjustment (paragraph 5-2b(4)(a)), the FSK frequency adjustment (paragraph 5-2b(4)(b)), and the bfo frequency adjustment (paragraph 5-2b(4)(c)).

(2) DETAILED CIRCUIT DESCRIPTION. - The detailed description of this unit is discussed on a functional circuit basis. The functional circuits are discussed as follows: oscillator V1A, buffer and output amplifier, CW break-in relay, and bfo circuit. Refer to servicing block diagram figure 4-22 and to schematic diagram figure 5-119.

TABLE 4-8. TEST EQUIPMENT FOR FUNCTIONAL TESTING OF CV-730/URC

QTY	EQUIPMENT	MODEL	MFR	CHARACTERISTICS
1	Electronic Voltmeter	ME-26A/U	Hewlett-Packard	Voltage range: 0 to 300 volts ac in 6 scales. 0 to 1000 volts dc in 7 scales. Frequency range: 20 cps to 700 mc. Accuracy: ±3 percent. A-c input impedance: 10 megohms. D-c input impedance: 122 megohms. Ohmmeter range: 10 ohms to 10 megohms in 7 ranges.
1	Audio Oscillator	TS-382/U	Hewlett-Packard	Frequency range: 20 cps to 200 kc in 4 bands. Frequency response: 10 volts into 1000-ohm load, 400-cps reference, 20-cps ±1 db, and 150 kc. Frequency accuracy: 6 percent. Frequency stability: 2 percent.

TABLE 4-8. (Continued)

QTY	EQUIPMENT	MODEL	MFR	CHARACTERISTICS
1	Oscilloscope	OS-46/U	DuMont	Vertical Channel (Y-Axis) Deflection factor: Amplifier: 0.1 volt peak-to-peak full scale; or 0.025 peak-to-peak volt/inch (0.009 rms volt/inch). Direct: 32 to 39 peak-to-peak volt/inch (12 to 14 rms volts/inch). Input impedance: Amplifier: 2 megohms, 50 uuf (single-ended); 4 megohms, 40 uuf (balanced). Direct: 1.5 megohms, 20 uuf (single-ended); 3.0 megohms, 20 uuf (balanced). Horizontal Channel (X-Axis) Deflection factor: Amplifier: 0.3 peak-to-peak volt/inch (0.1 rms volt/inch). Direct: 40 to 50 peak-to-peak volt/inch (15 to 18 rms volts/inch). Input impedance: Amplifier: 2.2 megohms, 50 uuf. Direct: 1.5 megohms, 20 uuf (single-ended); 3 megohms, 20 uuf (balanced).

(a) OSCILLATOR V1A. - Oscillator V1A is a triode oscillator with a tuned circuit in the plate-to-grid feedback loop. When switch S1B is in the FSK position, the tuned circuit consists of L1, C3, and the capacitors in the FSK keying circuit. The teletypewriter input at pin 1 of J1 determines which capacitors of the FSK keying circuit are inserted in the tuned circuit and therefore determines the frequency of the oscillator. With no current in the teletypewriter loop (space condition), voltage divider R11 and an external resistor or R12 applies a negative voltage across CR2 and CR3 from the -90-volt bias line causing conduction. With CR2 and CR3 conducting, C4 and C5 are placed in the tuned circuit of the oscillator and the oscillator is tuned to 1575 cps. When the mark current is present in the teletypewriter loop, the positive voltage developed across the external resistor or R12 cuts off CR2 and CR3. This effectively removes C4 and C5 from the tuned circuit of the oscillator and the oscillator is tuned to 2425 cps. In the CW 1KC position, switch S1B removes the capacitors in the FSK keying circuit and inserts capacitor C8 in the oscillator tuned circuit, tuning the oscillator to 1 kc. In the CW 1.5KC position, capacitor C9 is inserted in the oscillator-tuned circuit, tuning the oscillator to 1.5 kc.

(b) BUFFER AND OUTPUT AMPLIFIER. - The output of oscillator V1A is fed to buffer V1B. In the FSK position, switch S1A applies a ground to grid resistor R8. In the two CW positions, buffer V1B is biased to cutoff through R9 by voltage divider R10 and R17. The buffer is then keyed by the CW key line which applies a ground to the junction of voltage divider R10 and R17, removing the cutoff voltage from the grid of buffer V1B. The output of the buffer is fed to the grid of output amplifier V2A through a band-pass filter which has a rejection notch at 3 kc. On CW operation, this notch attenuates the second harmonic of 1.5 kc and the third harmonic of 1.0 kc. On FSK operation, the second harmonic of the 1575-cps space frequency is attenuated. Potentiometer R19 controls the signal input to the grid of amplifier V2A. The output of the output amplifier is fed to the primary of output transformer T1. The secondary of this transformer is 600 ohms, center-tapped, which supplies the 600-ohm balanced output to the sideband generator. Switch S1A and S1B connect the transformer secondary to the USB transmit output line in the CW and FSK positions. In the OFF position, the switch connects the USB transmit input line directly to the USB transmit line.

(c) CW BREAK-IN RELAY CIRCUIT. - The CW break-in relay circuit applies a ground to the transmit key line whenever the CW key is closed and maintains this ground through the normal CW key open intervals of a CW transmission. In the two CW positions, switch S1D connects the CW and FSK key line to the CW break-in relay circuit. The relay circuit operates on a fast attack and a delayed release principle. This is accomplished by controlling the grid voltage of V2B from two RC circuits, one with a short time constant and one with a long time constant. In the initial key-up condition. capacitor C13 is charged to approximately -20 volts by voltage divider R10 and R17. This voltage maintains V2B in a cutoff condition and relay K1 is de-energized. When the CW key is closed, a ground is applied to the CW and FSK key line and capacitor C13 is discharged through the small forward resistance of CR4. This removes the bias voltage from the grid of V2B, the tube conducts, and K1 is energized placing a ground on the transmit key line. When the CW key is opened, the ground is removed from the CW and FSK key line, and capacitor C13 is charged through the high resistance of R16 and R18. When the voltage at the tap of R18 reaches the cutoff value of V2B, the tube is again cut off and relay K1 is de-energized, removing the ground from the transmit key line. The long time constant of R10, R17, and C13 provides the time delay necessary to maintain the transceiver in the transmit condition during the normal key-open interval of a CW transmission. When switch S1D is in the OFF or FSK position, the CW and FSK key line is connected to the transmit key line. The CW and FSK key line can then be used as a remote transmit key line.

(d) BFO CIRCUIT. - The bfo circuit consists of a transistor oscillator and an electronic switch which disconnects the 100-kc input signal, J2, from the 100-kc output jack, J3. The bfo operates only during FSK receive operation. In other modes of operation, a 100-kc signal from J2 is applied to J3 through A1C5 and switching diode A1CR1. The switching diode is maintained in a conducting state by a bias voltage obtained from voltage divider A1R1 and A1R2. The d-c path for A1CR1 is through A1R3, R26, R25, and S1D. In the OFF, CW 1.5KC, and CW 1.0KC positions, S1D applies a ground to complete the d-c path of A1CR1. In FSK transmit operation, the d-c path is completed by the ground on the transmit key line. On FSK receive operation, +28 volts d-c unfiltered is applied to the transmit key line through DS1 and R13. This voltage is applied to the bfo circuits by oscillator control switch S1D, which cuts off switching diode A1CR1, thereby, disconnecting J2 from J3, and energizing bfo A1Q1. The positive voltage from S1D is applied to switching diode A1CR1 through a filter network consisting of R25, R26, C14, C15, and A1R3. This positive voltage is higher than the peak voltage across A1R2 and switching diode is maintained in a cutoff condition. The bfo is energized by applying the operating voltage through CR5 and filtering network R27, C16, A1R4, and A1C4. The frequency of the bfo is determined by parallel resonant tank circuit A1L1, A1C9, A1C10, and A1C11 which is in series with the collector of A1Q1. Inductor A1L1 is adjusted for a center frequency of 300.550 kc and front panel control A1C11 provides a means of varying the frequency approximately 1 kc above or below this center frequency. Oscillation is sustained by positive feedback from the tap on A1L1 to the emitter of A1Q1 through A1C7. The output of the bfo is also obtained from the A1L1 tap and fed to J3 through A1C8.

f. AMPLIFIER-CONTROL AM-2062/URC AND AM-2062A/URC.

Note

Amplifier-Control AM-2062/URC is used in Radio Set AN/URC-32. Amplifier-Control AM-2062A/URC is used in Radio Set AN/URC-32A and 32B.

Amplifier-Control AM-2062/URC and AM-2062A/URC (audio and control unit) are dual-channel amplifiers which will handle two line inputs or one line input and one remote input. In normal operation, the output from one channel feeds the lower-sideband balanced modulator of the sideband generator, while the other channel feeds the upper-sideband balanced modulator of the sideband generator. A speaker amplifier provides an amplified audio output for the speaker connections. The basic differences between the AM-2062/URC unit and the AM-2062A/URC unit are as follows: The AM-2062/URC unit has a microphone input, microphone amplifier, and uses two model 356C-1 line amplifiers. The AM-2062A/URC unit does not have a microphone input nor microphone amplifier and uses two Line Amplifiers AM-3198/URC. Both units use an identical speaker amplifier. Figure 4-23 is a block diagram of Amplifier-Control AM-2062( )/URC with appropriate notations specifying the differences between the AM-2062/URC and AM-2062A/URC. The SIDEBAND SELECTOR switch controls the audio signals during transmission and reception. With the switch in the LOCAL OFF position, the microphone amplifier circuits or the remote audio input are disconnected from the sideband line amplifiers. This also connects the upper- and lower-sideband audio line inputs to the line amplifiers. With the SIDEBAND SELECTOR in the USB position, the microphone audio or remote audio is placed into the upper-sideband line amplifier. This also selects the upper-sideband audio output from the sideband generator and applies it to the speaker amplifier circuit. The reverse happens when the SIDEBAND SELECTOR is in the LSB position.

The upper- and lower-sideband line amplifiers are controlled by the upper- and lower-sideband audio inputs. With the SIDEBAND SELECTOR in the LOCAL OFF position, the two sideband amplifiers can be used either alternately or simultaneously. Assume the audio input is on the upper sideband. This input is coupled by transformer T2 and the SIDEBAND

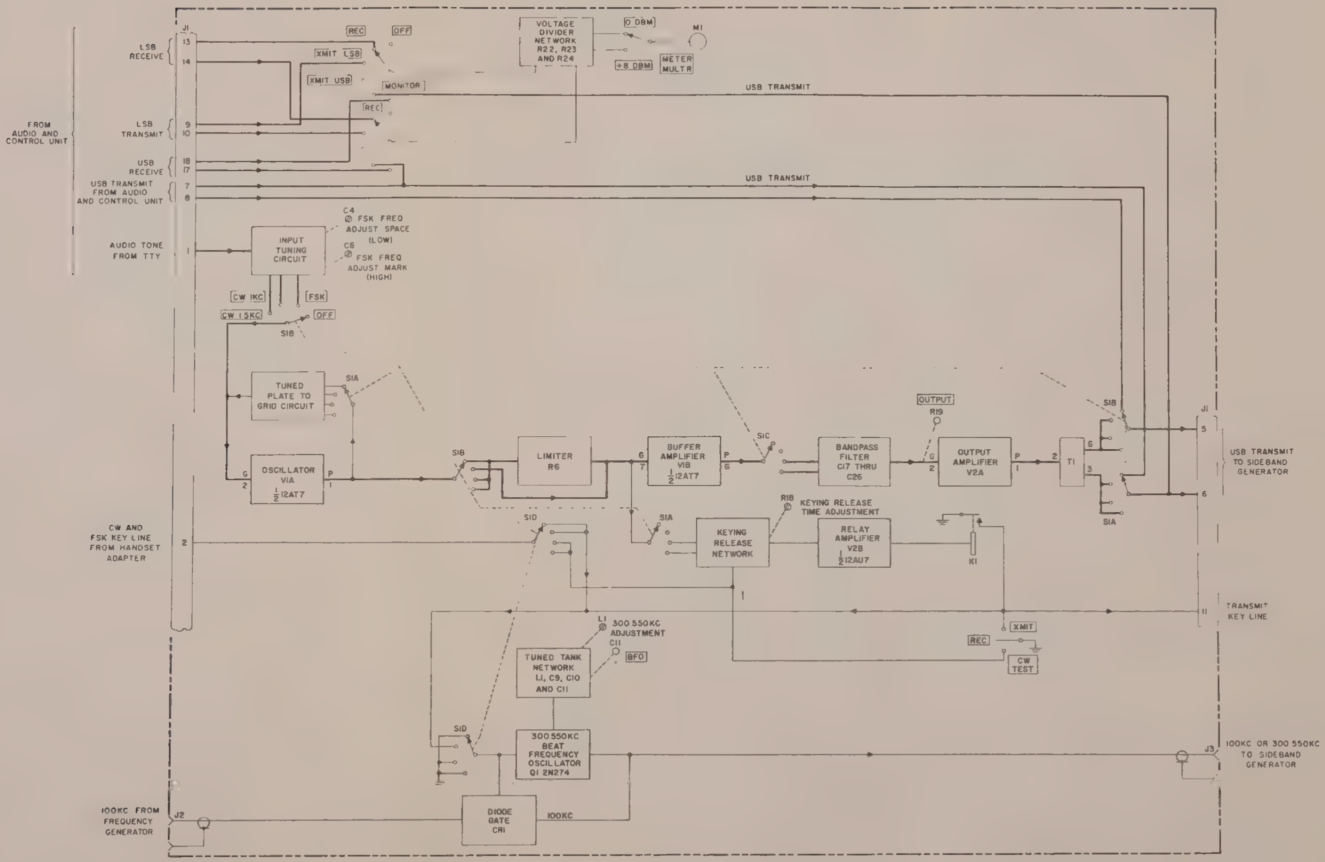
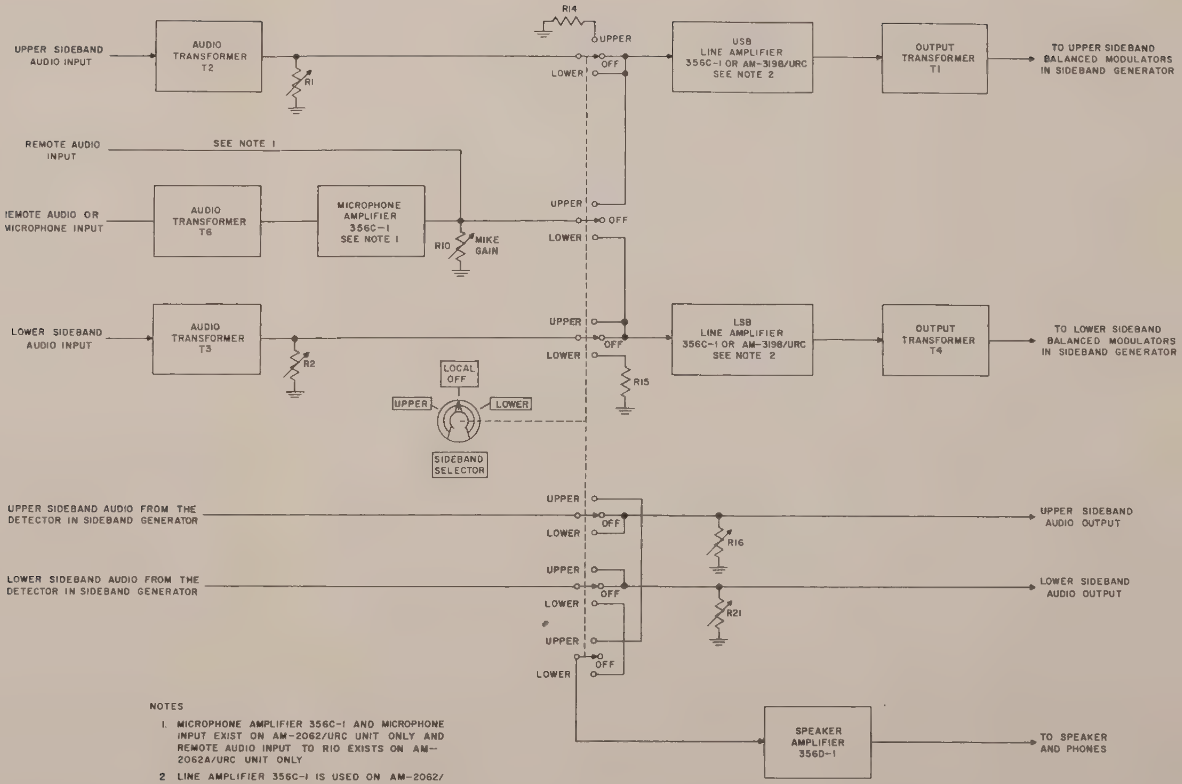

FROM AUDIO AND CONTROL UNIT
LSB RECEIVE
LSB TRANSMIT
USB RECEIVE
USB TRANSMIT FROM AUDIO AND CONTROL UNIT
AUDIO TONE FROM TTY
CW AND FSK KEY LINE FROM HANDSET ADAPTER
100KC FROM FREQUENCY GENERATOR
J1
13
14
9
10
18
17
7
8
1
2
J2
REC
OFF
XMIT LSB
XMIT USB
MONITOR
REC
VOLTAGE DIVIDER NETWORK R22, R23 AND R24
0 DBM
+8 DBM
M1
METER MULTR
USB TRANSMIT
USB TRANSMIT
INPUT TUNING CIRCUIT
C4
FSK FREQ ADJUST SPACE (LOW)
C6
FSK FREQ ADJUST MARK (HIGH)
CW 1KC
FSK
CW 1.5KC
OFF
S1B
TUNED PLATE TO GRID CIRCUIT
S1A
OSCILLATOR V1A ½ 12AT7
G
2
P
1
S1B
LIMITER R6
BUFFER AMPLIFIER V1B ½ 12AT7
G
7
P
6
S1C
BANDPASS FILTER C17 THRU C26
OUTPUT
R19
OUTPUT AMPLIFIER V2A
G
2
P
1
2
T1
6
3
S1B
S1A
J1
5
6
USB TRANSMIT TO SIDEBAND GENERATOR
S1D
S1A
R18
KEYING RELEASE TIME ADJUSTMENT
KEYING RELEASE NETWORK
RELAY AMPLIFIER V2B ½ 12AU7
K1
11
TRANSMIT KEY LINE
XMIT
REC
CW TEST
L1
300 550KC ADJUSTMENT
C11
BFO
TUNED TANK NETWORK L1, C9, C10 AND C11
S1D
300 550KC BEAT FREQUENCY OSCILLATOR Q1 2N274
DIODE GATE CR1
100KC
J3
100KC OR 300 550KC TO SIDEBAND GENERATOR

Figure 4-22. Converter-Monitor CV-730/URC, Servicing Block Diagram


R14
UPPER
UPPER SIDEBAND AUDIO INPUT
AUDIO TRANSFORMER T2
R1
OFF
LOWER
USB LINE AMPLIFIER 356C-1 OR AM-3198/URC SEE NOTE 2
OUTPUT TRANSFORMER T1
TO UPPER SIDEBAND BALANCED MODULATORS IN SIDEBAND GENERATOR
REMOTE AUDIO INPUT
SEE NOTE 1
IEMOTE AUDIO OR MICROPHONE INPUT
AUDIO TRANSFORMER T6
MICROPHONE AMPLIFIER 356C-1 SEE NOTE 1
R10
MIKE GAIN
UPPER
OFF
LOWER
LOWER SIDEBAND AUDIO INPUT
AUDIO TRANSFORMER T3
R2
UPPER
OFF
LOWER
R15
LSB LINE AMPLIFIER 356C-1 OR AM-3198/URC SEE NOTE 2
OUTPUT TRANSFORMER T4
TO LOWER SIDEBAND BALANCED MODULATORS IN SIDEBAND GENERATOR
LOCAL OFF
UPPER
LOWER
SIDEBAND SELECTOR
UPPER SIDEBAND AUDIO FROM THE DETECTOR IN SIDEBAND GENERATOR
UPPER
OFF
LOWER
R16
UPPER SIDEBAND AUDIO OUTPUT
LOWER SIDEBAND AUDIO FROM THE DETECTOR IN SIDEBAND GENERATOR
UPPER
OFF
LOWER
R21
LOWER SIDEBAND AUDIO OUTPUT
UPPER
OFF
LOWER
SPEAKER AMPLIFIER 356D-1
TO SPEAKER AND PHONES

NOTES

1. MICROPHONE AMPLIFIER 356C-1 AND MICROPHONE INPUT EXIST ON AM-2062/URC UNIT ONLY AND REMOTE AUDIO INPUT TO R10 EXISTS ON AM-2062A/URC UNIT ONLY
2. LINE AMPLIFIER 356C-1 IS USED ON AM-2062/URC UNIT AND LINE AMPLIFIER AM-3198/URC IS USED ON AM-2062A/URC UNIT.

Figure 4-23. Amplifier-Control AM-2062/URC or AM-2062A/URC, Functional Block Diagram

SELECTOR switch to the upper-sideband line amplifier for amplification. The amplified output of the upper-sideband line amplifier is applied to output transformer T1. The output of T1 is coupled to the upper-sideband balanced modulator in the sideband generator. The gain of the upper-sideband line amplifier is controlled by attenuator R1. The lower-sideband line amplifier circuits operate in the same manner as the upper-sideband line amplifier circuits.

When the SIDEBAND SELECTOR is in the UPPER position, the upper sideband audio is removed from the upper sideband amplifier and is correctly terminated by R14. The microphone amplifier circuits or remote audio then is connected to the microphone amplifier (AM-2062/URC unit) or the remote audio input is connected directly to the SIDEBAND SELECTOR switch (AM-2062A/URC unit). With the SIDEBAND SELECTOR in the LSB position, the lower-sideband audio is removed from the lower-sideband line amplifier and correctly terminated by R15; the microphone amplifier or audio remote circuits are then connected to the lower-sideband line amplifier.

(1) FUNCTIONAL TEST DATA. - The following information provides over-all functional test data and equipment required for the audio and control unit.

(a) DETERMINING OVER-ALL PERFORMANCE. - The only operating check necessary is to switch the LOCAL SIDEBAND SELECTOR switch back and forth between USB and LSB positions, during system operation using both sidebands. The speaker (or phones) should produce both sideband signals. If trouble is suspected in the unit the line amplifiers may be interchanged to isolate the faulty upper- or lower-sideband line amplifier. Use the voltage and resistance charts located on the schematic diagram of the audio and control unit (figure 5-121) to trouble shoot the line amplifiers and speaker amplifier. For voltage measurements, the audio and control unit must be connected into a normally operating system. When measuring resistances, all power must be turned off and the module under inspection removed from the chassis. Table 4-9 is a trouble-shooting table for the AM-2062A/URC Line Amplifiers AM-3198/URC. Before performing the steps listed in table 4-9 perform the following test setup procedure for the line amplifiers.

1. Extend the faulty line amplifier module on the pendant cable.

2. Position the SIDEBAND SELECTOR switch to the LOCAL OFF position.

3. Adjust the screwdriver line input gain adjustments (R1 and R2) to their maximum clockwise position.

4. Connect the audio oscillator and vacuum-tube voltmeter across pins 11 and 12 of terminal strip C in the junction box when trouble shooting the USB module, and pins 1 and 2 of terminal board C when trouble shooting the LSB module.

5. Adjust the audio oscillator output to 1000 cps and 5.5 millivolts across the 600-ohm input as indicated on the vacuum-tube voltmeter. Use the AM-2062A/URC unit schematic diagram figure 5-121 and servicing block diagram figure 4-24 as an aid in performing the trouble-shooting steps listed in table 4-9.

TABLE 4-9. LINE AMPLIFIER AM-3198/URC TROUBLE SHOOTING CHART

STEP	PRELIMINARY ACTION	NORMAL INDICATION	NEXT STEP
1	Connect the vtvm between the base of amplifier Q1 and chassis ground. Refer to the initial test setup.	The vtvm indicates approximately 2.25 mv ac.	Check input transformer T1; resistors R1 and R2; and diodes CR1, CR2, CR3, and CR4.
2	Connect the vtvm between the collector of amplifier Q1 and chassis ground.	The vtvm indicates approximately 447 mv ac.	Check amplifier Q1 as directed in step 7. If normal indications are observed for step 7, check components in Q1 amplifier stage.
3	Connect the vtvm between the emitter of isolation amplifier Q2 and chassis ground.	The vtvm indicates approximately 442 mv ac.	Check isolation amplifier Q2 as directed in step 10.

TABLE 4-9. (Continued)

STEP	PRELIMINARY ACTION	NORMAL INDICATION	NEXT STEP
4	Connect the vtvm between the base of output amplifier Q3 and chassis ground.	The vtvm indicates approximately 70 mv ac.	Check diode peak clippers CR5 and CR6. Check resistor R24. Measure d-c voltages to ground from Q2 emitter and Q3 base to locate faulty component.
5	Connect the vtvm between the collector of output amplifier Q3 and ground.	The vtvm indicates approximately 3.88 volts ac.	Check output amplifier Q3 as directed in step 16.
6	Connect the vtvm between the OUT jack J2 and chassis ground.	The vtvm indicates approximately -31.6 db below normal indication of step 5.	Check output transformer T2 for open winding or short circuit to ground.
7	Reconnect the vtvm across the IN jack J1 and chassis ground. Adjust the audio oscillator output level to obtain -30-dbm input (24.5 mv across 600-ohm input). Then connect the vtvm between the base of amplifier Q1 and chassis ground.	The vtvm indicates approximately 4.2 mv ac.	If normal indication was observed for step 1, but indication for step 7 is not normal, trouble is in signal compressor Q4 or Q5 or d-c amplifier Q6. Proceed to step 12.
8	Connect the vtvm between the collector of amplifier Q1 and chassis ground.	The vtvm indicates approximately 820 mv ac.	When abnormal indications are observed for steps 2 and 8, trouble is located in Q1 amplifier stage. Make d-c voltage checks with the vtvm to locate faulty component. Replace Q1 if required.
9	Connect the vtvm between the base of isolation amplifier Q2 and chassis ground.	The vtvm indicates approximately 820 mv ac.	Check circuit components between Q1 collector and Q2 base. Refer to figure 5-121.
10	Connect the vtvm between the emitter of isolation amplifier Q2 and chassis ground.	The vtvm indicates approximately 810 mv ac.	When abnormal indications are observed for steps 3 and 10, trouble is located in isolation amplifier Q2 stage. Make d-c voltage checks on Q2 terminals, and check component resistances to locate fault. Replace Q2 if required.

TABLE 4-9. (Continued)

STEP	PRELIMINARY ACTION	NORMAL INDICATION	NEXT STEP
11	Connect the vtvm between the base of output amplifier Q3 and chassis ground.	The vtvm indicates approximately 130 mv ac, or approximately -16 db below normal indications of step 10.	Check resistances of components in voltage-divider circuit between isolation amplifier Q2 emitter and output amplifier Q3 base.
12	Connect the vtvm between test point TP5 and ground.	The vtvm indicates approximately 580 mv ac.	Check capacitor C7 and resistor R19. Proceed to step 13. If normal indication is observed during step 12, omit step 13 and proceed to step 15.
13	Connect a 0.05-uf capacitor between base of isolation amplifier Q2 and ground. Then connect the vtvm between the collector of Q4 and ground.	The vtvm indicates approximately 32 mv ac.	Perform step 14.
14	Connect the vtvm between the base of Q4 and ground.	The vtvm indicates approximately 1.4 mv ac.	Make d-c voltage checks at emitter and base of Q4 to locate faulty component. Check transistor Q4 and replace if necessary.
15			If normal indications are observed for steps 1 through 6, but not for steps 7 through 11, check detector diodes CR7 and CR8, d-c amplifier Q6, and components located in quad compressor circuit.
16	Connect the vtvm between the collector of output amplifier Q3 and chassis ground.	The vtvm indicates approximately 6.3 volts ac.	Make d-c voltage checks of output amplifier Q3 terminals, and make d-c resistance checks of Q3 circuit components to locate fault. Replace output amplifier Q3 if necessary.

(b) EQUIPMENT AND TOOLS REQUIRED FOR FUNCTIONAL TESTING. - The test equipment and tools required for testing on the overall functional level are Audio Oscillator AN/URM-127, Electronic Voltmeter AN/USM-143, and Electronic Multimeter AN/USM-116.

(c) ADJUSTMENTS AND ALIGNMENTS. - The following adjustments are to be performed on the audio and control unit line-level adjustments (paragraph 5-2b(5)(a)), speaker amplifier gain adjustment (paragraph 5-2b(5)(b)), and mike and line amplifier gain adjustment (paragraph 5-2b(5)(c)).

(2) DETAILED CIRCUIT DESCRIPTION. - The circuit description is discussed on a module basis.

Note

Amplifier-Control AM-2062/URC uses Line Amplifier 356C-1 and Amplifier-Control AM-2062A/URC uses Line Amplifier AM-3198/URC. The earlier model Line Amplifier 356C-1 performs adequately except for TTY and voice independent sideband operation. Both line amplifier models are discussed.

The AM-2062/URC consists of four modules: the upper-sideband amplifier, the lower-sideband amplifier, the microphone amplifier, and the speaker amplifier. The AM-2062A/URC consists of three modules: upper- and lower-sideband amplifiers and the speaker amplifier (microphone amplifier deleted).

The speaker amplifier module is identical for both units. Unit AM-2062/URC modules are discussed in subparagraphs (a) through (d).

(a) UPPER-SIDEBAND LINE AMPLIFIER A1 356C-1. - Refer to schematic diagram figure 5-121. The upper-sideband amplifier is a transistorized two-stage amplifier. The input stage impedance is a nominal 100 ohms. The audio input is fed through A1R108 and capacitor A1C101 to the base of transistor A1Q101. Resistors A1R108 and A1R109 are audio input voltage dividers. A1R109 is a manual gain control. The base connection operates at a positive potential and receives some audio feedback through resistor A1R110 from the amplifier output circuit. The emitter operates at a positive potential with respect to the base. Capacitor A1C102 bypasses emitter resistor A1R103 to prevent degeneration. The collector operates negative with respect to the base and employs coupling transformer A1T101 as a load. The output of the coupling transformer feeds through capacitor A1C103 to the base of output transistor A1Q102. A positive bias to the base of A1Q102 develops through resistor A1R104. The emitter connection to A1Q102 has the highest positive potential applied to it; therefore, it operates positive with respect to the base. The emitter is bypassed to ground by capacitor A1C104 to prevent degeneration through A1R106 and A1R107. The collector, together with output transformer A1T102 as its load, operates negative with respect to the base. The impedance of the output winding of transformer A1T102 is 500 ohms. Negative feedback from the collector to the base through resistor A1R105 reduces distortion. The over-all gain of the amplifier is approximately 40 db.

(b) LOWER-SIDEBAND LINE AMPLIFIER A2 356C-1. - The operation of this amplifier is the same as that for the upper-sideband line amplifier.

(c) MICROPHONE AMPLIFIER A3 356C-1. - The operation of this amplifier is the same as that for the upper-sideband amplifier A1.

(d) SPEAKER AMPLIFIER A4 356D-1. - The speaker amplifier module provides three watts output to drive a loudspeaker. The circuit consists of Q201 and Q202 operating class B push-pull. The value of the input audio is adjusted by A4R205. Input transformer A4T201 has a split secondary, each half of which is connected to a separate class B amplifier consisting of a transistor, a bias resistor, and a stabilizing resistor.

In operation, each transistor is biased to cutoff by its bias resistor, A4R201 for A4Q201 and A4R202 for A4Q202. Resistors A4R204, A4R203, and the two secondary windings of A4T201 connect in series across the 28-volt supply. Capacitor A4C201 connects at the electrical center of these series components, and, therefore, is charged to a positive 14 volts. The transistors on one half of the input cycle will try to add to this charging voltage and on the other half of the audio input cycle will try to discharge the capacitor. This causes A4Q202 to cut off on one half of the input audio cycle and A4Q201 to conduct between emitter and collector. The resultant pulse of current across A4C201 flows through the load. On the other input half cycle, A4Q201 cuts off and A4Q202 conducts. The resultant audio is applied through A4C201 to the headphones or the output transformer. Resistors A4R201 and A4R202 produce self-bias to stabilize the operating points of the transistors during temperature changes. A one-ampere fuse, A4F201, is provided in the 28-volt d-c bias supply line.

The AM-2062A/URC modules are discussed in subparagraphs (e) through (g).

(e) UPPER-SIDEBAND AMPLIFIER AM-3198/URC. - Refer to the servicing block diagram in figure 4-23 and the schematic diagram in figure 5-121. The line amplifier functions as a limiter amplifier consisting of three audio stages, Q1 through Q3, and three compressor amplifier stages, Q4 through Q6. Diodes CR1 through CR4 act as a variable shunting impedance (the value of the impedance varies with the audio input signal level). Compressor amplifier stages Q4 and Q5 control the conduction of compressor amplifier Q6, and therefore the biasing of diodes CR1 through CR4. This in turn controls the audio level applied to the base of Q1.

Under static conditions, with no input signal applied, no current flows through the diode network (CR1 through CR4). Under these conditions, the diode network acts as a high-impedance shunt across the secondary of T1. Under dynamic conditions, audio applied to the base of Q1 is amplified and coupled to the base of Q2 (an emitter follower functioning as an isolation amplifier). Part of the output of Q2 is

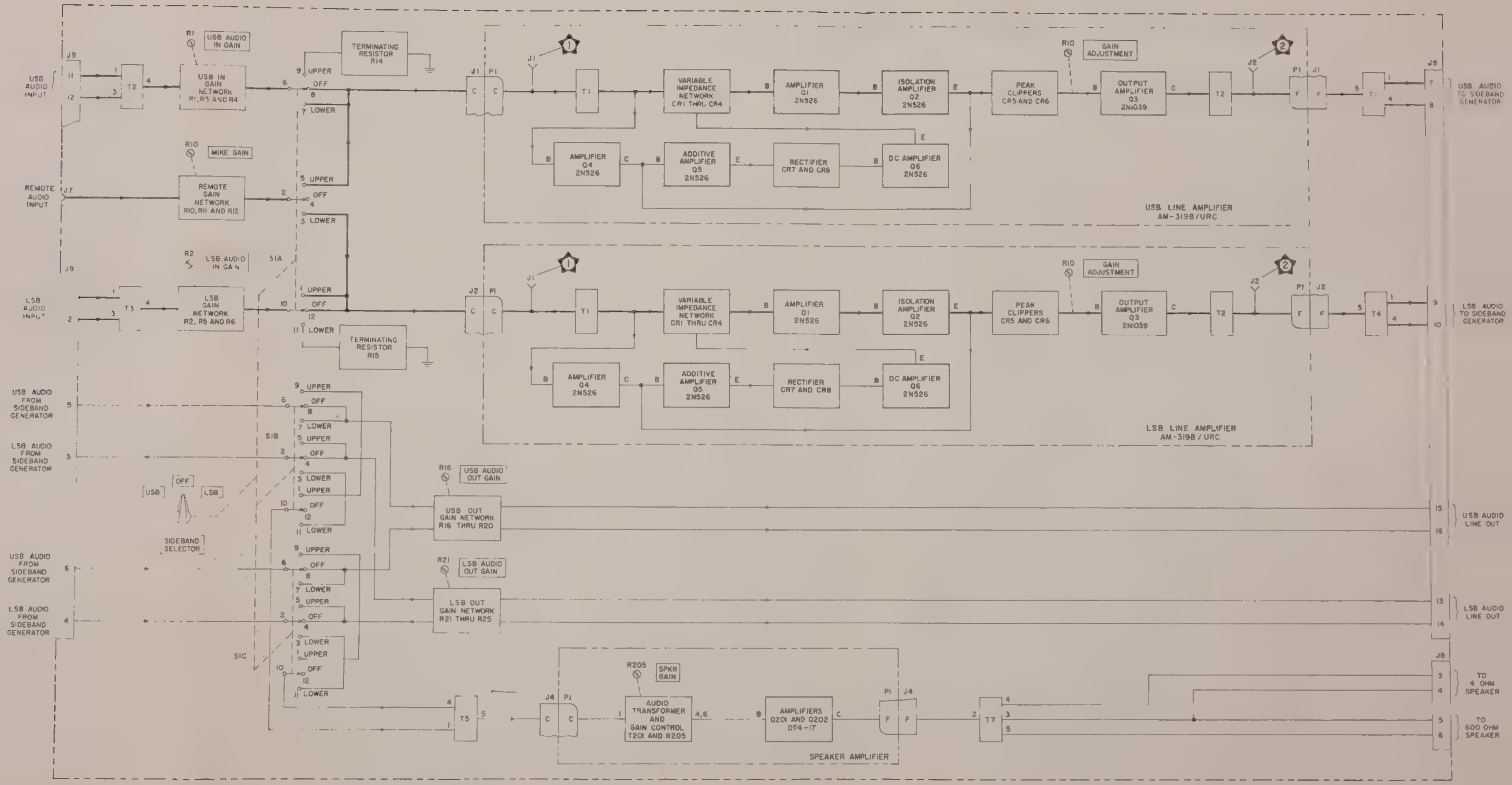

USB AUDIO INPUT
J9
11
12
T2
R1
USB AUDIO IN GAIN
USB IN GAIN NETWORK R1, R3 AND R4
TERMINATING RESISTOR R14
UPPER
OFF
LOWER
R10
MIKE GAIN
REMOTE AUDIO INPUT
J7
REMOTE GAIN NETWORK R10, R11 AND R12
R2
LSB AUDIO IN GAIN
S1A
LSB AUDIO INPUT
T3
LSB GAIN NETWORK R2, R5 AND R6
TERMINATING RESISTOR R15
J1
P1
J2
1
2
T1
VARIABLE IMPEDANCE NETWORK CR1 THRU CR4
AMPLIFIER Q1 2N526
ISOLATION AMPLIFIER Q2 2N526
PEAK CLIPPERS CR5 AND CR6
GAIN ADJUSTMENT
OUTPUT AMPLIFIER Q3 2N1039
AMPLIFIER Q4 2N526
ADDITIVE AMPLIFIER Q5 2N526
RECTIFIER CR7 AND CR8
DC AMPLIFIER Q6 2N526
USB LINE AMPLIFIER AM-3198/URC
LSB LINE AMPLIFIER AM-3198 / URC
T4
USB AUDIO TO SIDEBAND GENERATOR
LSB AUDIO TO SIDEBAND GENERATOR
USB AUDIO FROM SIDEBAND GENERATOR
LSB AUDIO FROM SIDEBAND GENERATOR
S1B
OFF
USB
LSB
SIDEBAND SELECTOR
R16
USB AUDIO OUT GAIN
USB OUT GAIN NETWORK R16 THRU R20
USB AUDIO LINE OUT
R21
LSB AUDIO OUT GAIN
LSB OUT GAIN NETWORK R21 THRU R25
LSB AUDIO LINE OUT
S1C
T5
J4
R205
SPKR GAIN
AUDIO TRANSFORMER AND GAIN CONTROL T201 AND R205
AMPLIFIERS Q201 AND Q202 DT4-17
SPEAKER AMPLIFIER
T7
J8
TO 4 OHM SPEAKER
TO 600 OHM SPEAKER

Figure 4-24. Amplifier-Control AM-2062A/URC, Servicing Block Diagram

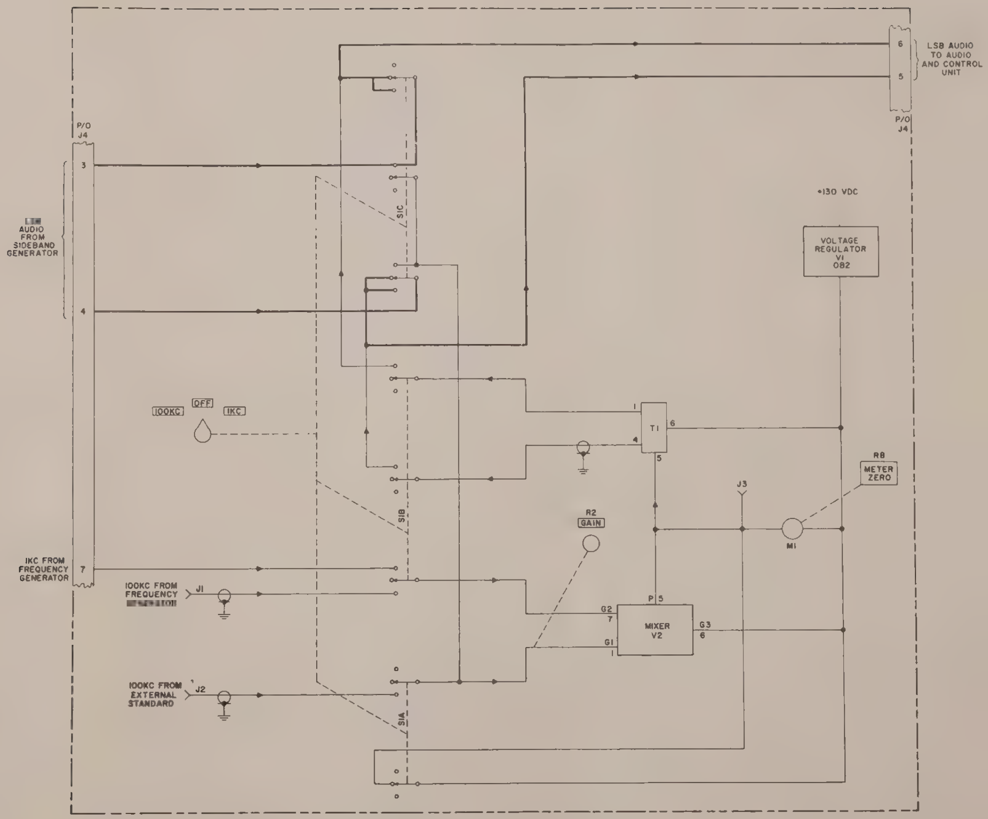

6
5
LSB AUDIO
TO AUDIO
AND CONTROL
UNIT
P/O
J4
P/O
J4
3
4
[redacted]
AUDIO
FROM
SIDEBAND
GENERATOR
SIC
+130 VDC
VOLTAGE
REGULATOR
VI
OB2
100KC
OFF
1KC
1
T1
6
4
5
R8
METER
ZERO
J3
SIB
R2
GAIN
M1
1KC FROM
FREQUENCY
GENERATOR
7
100KC FROM
FREQUENCY
[redacted]
J1
P 5
G2
7
MIXER
V2
G3
6
G1
1
100KC FROM
EXTERNAL
STANDARD
J2
SIA

Figure 4-25. Signal Comparator CM-126/UR, Servicing Block Diagram

coupled through C7 and R17 to compressor amplifier Q5, while the remaining output is coupled to the audio amplifier stage, Q3, to be amplified and applied to the 600-ohm output transformer, T2. Audio from the top of the T1 secondary is coupled through C1 and R23 to the base of compressor amplifier Q4, amplified, and coupled to the base of Q5. At the same time, audio output from isolation amplifier Q2 is coupled to the base of Q5. Both of these signals are in phase due to the 180-degree phase shift in both signals. (In the case of the audio output signal from Q2, the only phase shift is that obtained through Q1; the emitter follower does not develop a phase shift. In the case of the audio output from Q4, the only phase shift developed is that across Q4. Therefore the two signals applied to the base of Q5 are in phase and additive.) The output of Q5 is rectified by diodes CR7 and CR8 (which functions as a voltage-doubler circuit) and applied as a d-c bias to the base of Q6. Diodes CR7 and CR8 control the compressor threshold level of the system by not conducting until a few tenths of a volt of audio signal is present at the emitter of Q5. The resultant output of Q6 varies the bias current through the diode (CR1 through CR4) network, varying the effective impedance of this network, and therefore the audio applied to the base of Q1. Any audio input signal level high enough to break the threshold level is partially fed back as an increased negative bias to the base of compressor amplifier Q6, increasing the conduction through Q6, applying a higher forward bias current to diodes CR1 through CR4. This decreases the impedance shunt across the secondary of T1, applying less audio to the base of Q1.

Any audio input signal level not high enough to break the compressor threshold has no effect on the conduction of Q6, therefore returning the diode network (CR1 through CR4) impedance to its static condition. Under this condition, the diode network acts as a high-impedance shunt across the secondary of T1, delivering maximum audio to the base of Q1.

The above shows the limiting action that is obtained in the circuit. Signal peaks of 4 db or more above the compressor threshold level are limited by a symmetrical clipper consisting of diodes CR5 and CR6. Resistor R22 drops the 27.5-volt d-c supply to 13 volts d-c as determined by the Zener diode action of CR9.

(f) LOWER-SIDEBAND LINE AMPLIFIER A2 AM-3198/URC. - The operation of this amplifier is the same as that for the Upper-Sideband Line Amplifier A1 AM-3198/URC discussed in subparagraph (e).

(g) SPEAKER AMPLIFIER A3 356D-1. - The operation of this amplifier is the same as that for Speaker Amplifier A4 356D-1 discussed in subparagraph (d) for the AM-2062/URC.

g. SIGNAL COMPARATOR CM-126/UR. - Signal Comparator CM-126/UR (frequency comparator) compares the reference oscillator frequency with an external frequency standard. Two comparison methods are provided. The first method compares a 100-kc reference oscillator frequency with a 100-kc external standard without interrupting normal operation of the AN/URC-32( ) system. The second method compares an operating frequency with a net control frequency standard or any other transmitted frequency standard such as WWV. The second method results in interruption of service. A front panel meter oscillates at the frequency difference rate between the signals being compared. By counting the number of oscillations during a period of time, the frequency difference can be determined. When an operating frequency is compared with a transmitted frequency standard, the output from the frequency comparator can be supplied to a speaker. The frequency differences which are too great to be indicated on the meter are then heard as a beat note.

(1) FUNCTIONAL TEST DATA. - The following information provides over-all functional test data and equipment required for the frequency comparator.

(a) DETERMINING OVER-ALL PERFORMANCE. - Malfunctions in the frequency comparator can be detected by observing the unit operation when performing frequency comparison.

1. OPERATING PROCEDURE USING 100-KC EXTERNAL FREQUENCY STANDARD.

a. Turn the front panel GAIN control to the counterclockwise stop.

b. Turn the front panel FREQUENCY SELECTOR to the 100 KC position.

c. Adjust the METER ZERO control to obtain a zero reading on the meter.

d. Turn the GAIN control clockwise for a reasonable meter deflection.

e. Clock the time (T) required for the meter to make N complete cycles, and determine the frequency difference using the following formula. A complete meter cycle is from maximum on one side to maximum on the other side and back to the original position.

$$\text{Frequency difference} = \frac{10N}{T} \text{ parts per } 10^6,$$

where the frequency is 100 kc.

T = time in seconds
N = number of complete meter cycles in T seconds

For example, when comparing the transmitter-receiver reference oscillator signal to an external 100-kc frequency standard, the meter completes one cycle in 10 seconds.

$$\text{Frequency difference} = \frac{10N}{T} = \frac{10(1)}{10} =$$
$$1 \text{ part per } 10^6$$

2. OPERATING PROCEDURE USING A TRANSMITTED FREQUENCY STANDARD. - The following procedure is used to determine the accuracy of the transmitter-receiver operating frequency by comparing it to a transmitting station such as WWV.

a. Tune the receiver to 1 kc above the transmitting station frequency (WWV frequencies are 2.5, 5, 10, 15, 20, 25, and 30 mc).

b. Turn the sideband selector switch on the audio and control unit to the LSB position.

c. Turn the receiver r-f gain control on the sideband generator to the clockwise stop.

d. Turn the GAIN control to the counterclockwise stop.

e. Turn the FREQUENCY SELECTOR switch to the 1 KC position.

f. Turn the GAIN control clockwise for a reasonable meter deflection or an audible beat note from the speaker.

Note

If the frequency difference is too great, the meter will read zero.

g. Clock the time (T) required for the meter to make N complete cycles, and determine the frequency difference using the following formula. A complete meter cycle is from maximum on one side to maximum on the other side and back to the original position.

$$\text{Frequency difference} = \frac{N}{Tf} \text{ parts per } 10^6$$

T = time in seconds

N = number of complete meter cycles in T seconds

f = frequency of transmitting station (WWV) in megacycles

Example: When the receiver is tuned to 1 kc above WWV at 10 mc, the meter completes 30 cycles in a period of 30 seconds.

$$\text{Frequency difference} = \frac{N}{Tf} = \frac{30}{30x10} = 0.1 \text{ part per } 10^6$$

If the operation of the frequency comparator indicates that the unit is malfunctioning, conventional trouble-shooting procedures using the servicing block diagram figure 4-25, schematic diagram figure 5-122.

The following conditions must exist when making the voltage measurements:

FREQUENCY SELECTOR switch in OFF position.

Input voltage at J4-10 must be +130 volts dc.

Input voltage at J4-1, 2 must be 6.3 volts ac.

(b) EQUIPMENT REQUIRED FOR FUNCTIONAL TESTING. - The ME-26A/U is necessary for testing on the over-all functional level.

(c) ADJUSTMENT AND ALIGNMENTS. - The only adjustments necessary for proper operation of this unit are included as part of the operating procedures.

(2) DETAILED CIRCUIT DESCRIPTION. - Refer to schematic diagram figure 5-122. The frequency comparator compares two frequencies by injecting them into a mixer and metering the difference output. The frequency selector switch has three positions: OFF, 100 KC, and 1 KC. In the OFF position, no signals are fed to the mixer, and the LSB audio output from the transmitter-receiver sideband generator is fed to the audio and control unit. In the 100 KC position, a 100-kc signal from the frequency generator is fed to one grid of the mixer, and a 100-kc signal from an external standard is fed to the other grid of the mixer through a gain control. In the 1 KC position, a 1-kc signal from the frequency generator is fed to one grid of the mixer, and the LSB audio from the sideband generator is fed to the other grid of the mixer through a gain control. In the 1 KC position, the LSB audio input is disconnected from the audio and control unit and is replaced with the output from the mixer. The output of the mixer also is fed to a meter connected to the plate of the mixer. The d-c plate voltage of the mixer is balanced out by applying an equal voltage to the opposite side of the meter from a voltage divider. Due to the damping of the meter movement, the meter responds only to small difference frequencies of the mixer.

h. CONTROL-POWER SUPPLY C-2691/URC. - Control-Power Supply C-2691/URC (handset adapter) permits local or remote operation of Radio Set AN/URC-32( ) using the dynamic handset for local operation and Radio Set Control C-1138/UR plus a dynamic headset for remote operation. Local or remote operation is selected by the HANDSET switch on the front panel.

(1) FUNCTIONAL TEST DATA. - The following information provides over-all functional test data and equipment required for the handset adapter.

(a) DETERMINING OVER-ALL PERFORMANCE. - If the handset adapter is suspected of malfunction use handset servicing block diagram figure 4-26 and schematic diagram figure 5-124 as aids in performing conventional trouble-shooting procedure on the unit. Use a vtvm (ME-26A/U) to isolate the malfunction to a component part of the unit.

(b) EQUIPMENT REQUIRED FOR FUNCTIONAL TESTING. - The test equipment required for testing on the over-all functional level consists of a vtvm (ME-26A/U).

(c) ADJUSTMENTS AND ALIGNMENTS. - No adjustments or alignments are required for this unit.

(2) DETAILED CIRCUIT DESCRIPTION. - Refer to schematic diagram figure 5-124. The handset adapter supplies transmitter/receiver audio input, audio output, and key line control to either a local handset or a remote control. In the LOCAL position, HANDSET switch S1 connects the audio output from the receiver to the handset and connects the audio output from the handset to the transmitter. In local operation, the key line is connected to the normally open contacts of relay R1 which ground the key line when the handset push-to-talk button is depressed. A 12-volt power supply supplies power for relay K1 and the handset microphone. In the REMOTE position, HANDSET switch S3 connects the

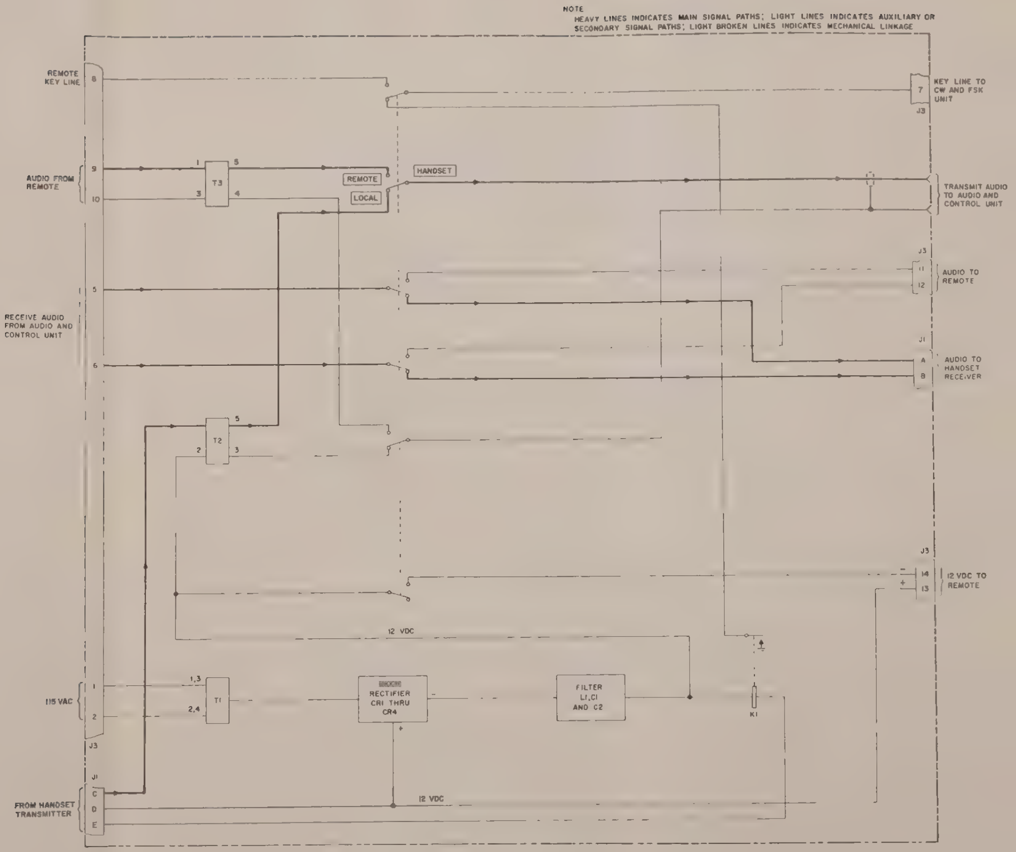
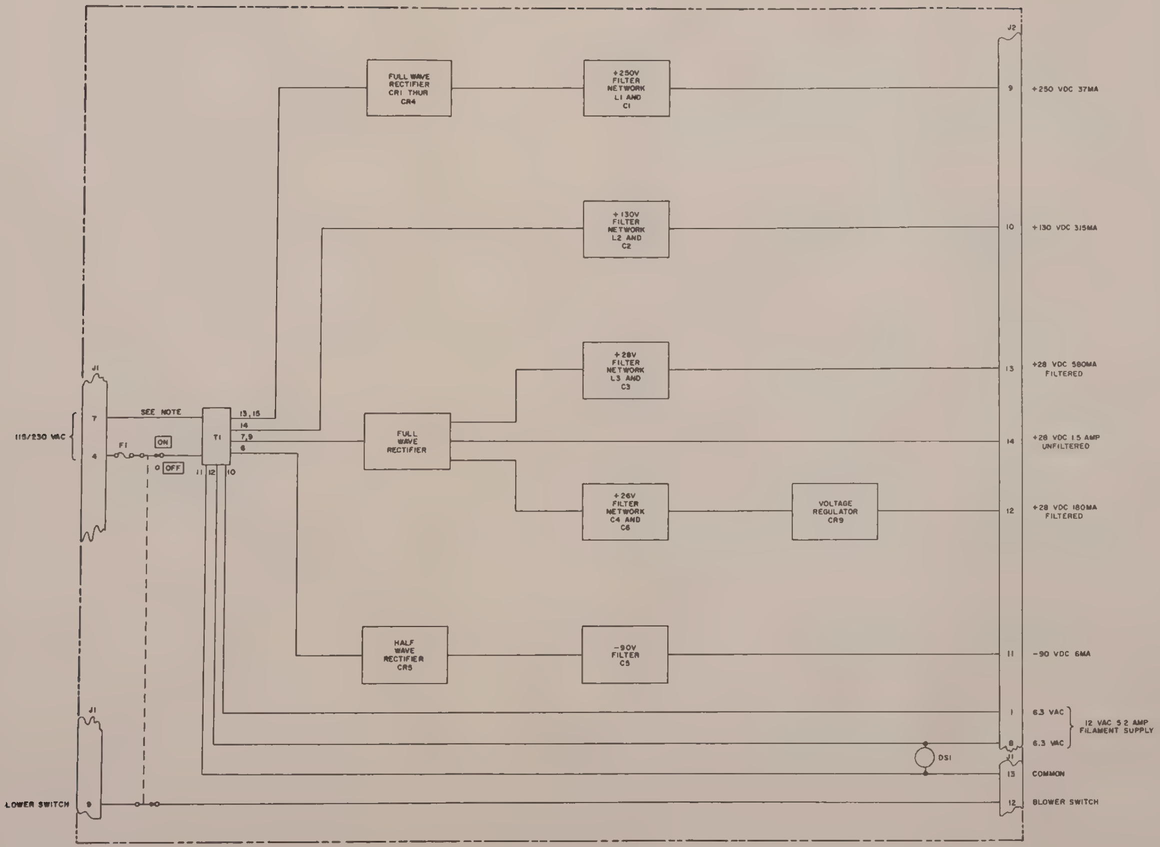

NOTE
HEAVY LINES INDICATES MAIN SIGNAL PATHS; LIGHT LINES INDICATES AUXILIARY OR SECONDARY SIGNAL PATHS; LIGHT BROKEN LINES INDICATES MECHANICAL LINKAGE
REMOTE KEY LINE
8
7
KEY LINE TO CW AND FSK UNIT
J3
AUDIO FROM REMOTE
9
10
1
5
3
4
T3
REMOTE
LOCAL
HANDSET
TRANSMIT AUDIO TO AUDIO AND CONTROL UNIT
J3
11
12
AUDIO TO REMOTE
5
RECEIVE AUDIO FROM AUDIO AND CONTROL UNIT
J1
A
B
AUDIO TO HANDSET RECEIVER
6
T2
5
2
3
J3
14
13
12 VDC TO REMOTE
12 VDC
115 VAC
1
2
1,3
2,4
T1
RECTIFIER CR1 THRU CR4
FILTER L1,C1 AND C2
K1
J3
J1
FROM HANDSET TRANSMITTER
C
D
E
12 VDC

Figure 4-26. Control-Power Supply C-2691/URC, Servicing Block Diagram


J2
FULL WAVE RECTIFIER CR1 THUR CR4
+250V FILTER NETWORK L1 AND C1
9
+250 VDC 37MA
+130V FILTER NETWORK L2 AND C2
10
+130 VDC 315MA
+28V FILTER NETWORK L3 AND C3
13
+28 VDC 580MA FILTERED
J1
SEE NOTE
13, 15
14
7,9
6
7
115/230 VAC
4
F1
ON
T1
0
OFF
11
12
10
FULL WAVE RECTIFIER
14
+28 VDC 1.5 AMP UNFILTERED
+26V FILTER NETWORK C4 AND C6
VOLTAGE REGULATOR CR9
12
+28 VDC 180MA FILTERED
HALF WAVE RECTIFIER CR5
-90V FILTER C5
11
-90 VDC 6MA
J1
1
6.3 VAC
12 VAC 5 2 AMP FILAMENT SUPPLY
8
6.3 VAC
DS1
J1
13
COMMON
LOWER SWITCH
9
12
BLOWER SWITCH

NOTE

FOR 115 VAC OPERATION JUMPER PINS 1 AND 3, AND PINS 2 AND 4. FOR 230 VAC OPERATION REMOVE 115 VAC JUMPERS AND JUMPER PINS 2 AND 3

Figure 4-27. Power Supply PP-2154/U, Servicing Block Diagram

audio output from the receiver to the remote control and connects the audio output from the remote control to the transmitter. In remote operation, the key line and 12 volts from the handset adapter power supply are connected to the remote controls.

i. DYNAMIC HANDSET H-169/U AND CORD CX-1846A/U. - Dynamic Handset H-169/U and Cord CX-1846A/U (dynamic handset) consists of a noise-canceling dynamic microphone incorporating a transistor amplifier, a dynamic receiver, and a push-to-talk switch. It is directly interchangeable with Navy 51007A carbon handset. The dynamic handset has the same plug connections, output impedance, and output level as the Navy 51007A carbon handset but has an improved audio quality. The dynamic handset is supplied with a 51-inch cord terminated with a AN-3106-145-5P connector.

(1) FUNCTION TEST DATA. - The following information provides over-all functional test data and equipment required for the dynamic handset. The transmitter and receiver units of the dynamic handset are sealed plug-in units and cannot be repaired. When either the receiver, the transmitter, or the push-to-talk switch is suspected of malfunction, the items should be replaced.

(2) DETAILED CIRCUIT DESCRIPTION. - Refer to schematic diagram figure 5-126. Both the transmitter and receiver are sealed plug-in units. The transmitter consists of a noise-canceling dynamic microphone and transistor amplifier. The receiver is a standard 600-ohm dynamic telephone receiver. The push-to-talk button applies 12 volts to a push-to-talk relay coil and closes the transmitter circuit. Since the 12-volt supply operates the transistor amplifier circuit of the transmitter, it is important that the polarity indicated on the schematic be observed.

j. POWER SUPPLY PP-2154/U. - Power Supply PP-2154/U (low-voltage power supply) provides several outputs of relatively low voltage. The voltage outputs are 12.6 volts ac; an unfiltered d-c output of +28 volts; a partly filtered output of +28 volts; and one filtered d-c output each of -90, +28, +130, and +250 volts.

(1) FUNCTIONAL TEST DATA. - The following information provides over-all functional test data and equipment required for the low-voltage power supply.

(a) DETERMINING OVER-ALL PERFORMANCE. - The trouble most likely to occur in the low-voltage power supply is a blown fuse. Use servicing block diagram (figure 4-27) and schematic diagram (figure 5-125) as a guide when trouble shooting the low-voltage power supply. Ensure that voltage measurements obtained agree with the schematic diagram. If trouble is suspected in the rectifiers, remove the applied power, and disconnect the unit. Check the forward and reverse resistance of the diodes with a vtvm (ME-26A/U) in the RX1 scale. The forward resistance should be 5 ohms, and the reverse resistance should be infinite on the RX1 scale.

(b) EQUIPMENT REQUIRED FOR FUNCTIONAL TESTING. - The test equipment required for testing on the over-all functional level consists of a vtvm (ME-26A/U).

(c) ADJUSTMENTS AND ALIGNMENTS. - No adjustments or alignments are required for this unit.

(2) DETAILED CIRCUIT DESCRIPTION. - Refer to servicing block diagram 4-27 and to schematic diagram figure 5-125. The a-c input voltage is applied to the primary of transformer T1 through S1. The secondary of the transformer is connected to the rectifier circuits. As shown in the block diagram, the power transformer supplies all the rectifier circuits. Schematic diagram, figure 5-128 shows the actual connection of the transformer secondary to the rectifiers. The +250-volt supply uses a full-wave bridge rectifier and a choke input filter. The +130-volt supply is connected to the center tap of the +250-volt supply and contains an LC filter. Indicator light DS1 is tied across the 12.6-volt a-c supply. The unfiltered +28-volt supply is taken directly across the full-wave rectifier diodes CR6 and CR7. The partly filtered +28-volt supply is taken across a one-section LC network. The filtered, regulated +28-volt d-c supply is isolated from the other 28-volt d-c supplies by diode CR8. This prevents C4 and C6 from discharging into the low impedance of the other supplies. After passing through an RC filter, the output voltage is clamped by Zener diode CR9 which conducts when the voltage across it rises above 27 volts d-c. The -90-volt supply uses a half-wave rectifier with an RC filter.

k. ELECTRONIC EQUIPMENT AIR COOLER HD-347/U. - Electronic Equipment Air Cooler HD-347/U (blower) is a centrifugal blower capable of delivering 125 cfm of air at a pressure equivalent to 1.83 inches of water. Refer to schematic figure 5-130. The blower is driven by a direct-coupled 115/230-volt single-phase induction motor. Terminal board jumpers are provided for operation on 115 or 230 volts. The air input to the blower is through an air filter located on the front of the blower. The blower includes a normally open dpst switch S1 which is actuated by air pressure. The contacts of the air pressure switch close when the pressure in the output chamber of the blower is equivalent to 0.85 inch of water and remain closed until the pressure drops below this value. These contacts are used as interlocks in the primary power to the system. Jumper connections on terminal board TB1 allow the blower to be operated on 115 or 230 volts ac. Connections are to be made as shown on schematic diagram 5-127 for the required voltage operation.

l. POWER SUPPLY PP-2153/U. - Power Supply PP-2153/U (high-voltage power supply) supplies high voltages to the system. The voltages are the 2000 volts dc at 500 ma and the 400 volts dc at 80 ma. Both of the voltages are used in the power amplifier unit. The unit consists of two bridge rectifiers, protective fuses and an interlock circuit.

(1) FUNCTIONAL TEST DATA. - The following information provides over-all functional test data and equipment required for the high-voltage power supply.

(a) DETERMINING OVER-ALL PERFORMANCE. -

WARNING

> Voltages dangerous to life (2000 volts dc) are present throughout the high-voltage power supply, and no attempt should be made to service the unit with the power applied. All capacitors in the unit should be discharged with a high-voltage shorting rod before touching any of the components.

The trouble most likely to occur in the high-voltage power supply is a blown fuse. Use the servicing block diagram figure 4-28 and schematic diagram figure 5-123 when performing trouble shooting on the high-voltage power supply. If trouble is suspected in the rectifiers, remove the applied power and disconnect the unit. Discharge all capacitors with the shorting rod. Check the forward and reverse resistance of the diode rectifiers with a vtvm (ME-26A/U) in the RX1 scale. The forward resistance should be 5 ohms and the reverse resistance should be infinite on the RX1 scale.

(b) EQUIPMENT REQUIRED FOR FUNCTIONAL TESTING. - The test equipment required for testing on the over-all functional level consists of a vtvm (ME-26A/U).

(c) ADJUSTMENTS AND ALIGNMENTS. - No adjustments or alignments are required for this unit.

(2) DETAILED CIRCUIT DESCRIPTION. - Refer to servicing block diagram figure 4-28 and the schematic diagram figure 5-123. The 115-volt ac (or 230-volt ac) input is applied to the high-voltage transformer T1 through the high-voltage relay K1. The output of the transformer is coupled to the two rectifier bridges which are connected in series to provide 2000- and 400-volt d-c output. The 400-volt d-c supply consists of CR1 through CR12 connected in a conventional full-wave bridge rectifier circuit. Capacitors C5 through C16 are connected across the diodes to distribute the inverse voltage more equally across the diodes. During the charge recovery time, each capacitor presents a similar low impedance to the transient voltage to distribute an equal voltage across each diode-capacitor pair. The output is fused by F2 and filtered by inductor L2 and resistor R1. The 400 volts is connected to the power amplifier through the junction box (J-1007/U). The 2000-volt d-c supply consists of CR13 through CR44, connected in a conventional full-wave bridge rectifier circuit. Capacitors C17 through C48 are connected across the diodes and serve the same function as capacitors C5 through C16. The output is filtered by inductor L1 and capacitors C1 and C2. Fuse F3 protects the circuit, and resistors R2, R3, and R4 are bleeders. Capacitor C3 is placed across the high-voltage secondary of transformer T1, and capacitor C4 across the low-voltage secondary of T1 to present a sufficiently low impedance to the switching transient voltage to reduce the peak to a safe peak inverse voltage value. As shown on the schematic diagram (figure 5-123), the power transformer can be wired for 115- or 230- volt single-phase input. Relay K1 applies the input voltage to the power transformer T1 when the power amplifier plate power is switched on.

4-4. CHECKOUT PROCEDURE FOR RADIO SET AN/URC-32( ) AND ANTENNA COUPLER GROUP AN/SRA-22.

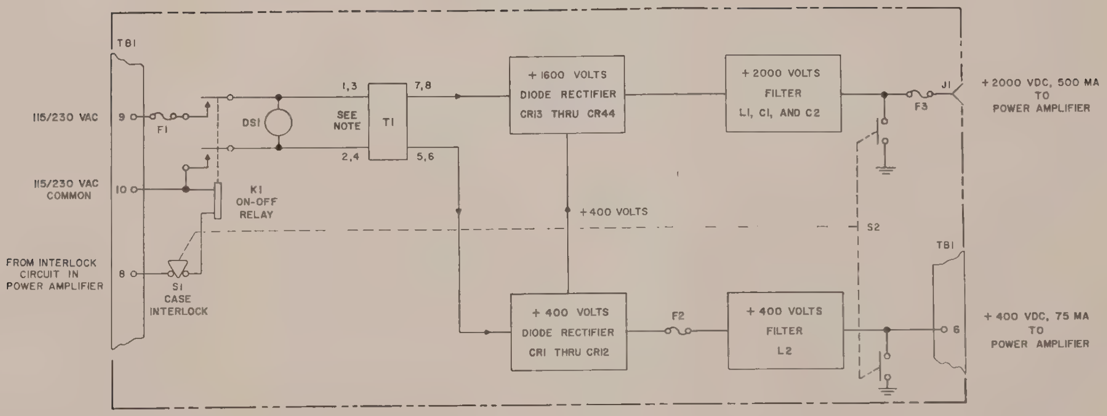
a. GENERAL. - This checkout procedure is written for the technician who is somewhat familiar with the AN/URC-32( ), at least to the point of being able to tune the equipment properly for its various modes of operation in SSB, ISB, AM, CW, and FSK. If the following step-by-step procedure is adhered to, the technician can determine whether or not his equipment is functioning properly.

Failure of the AN/URC-32( ) to give correct indications as set forth in the following steps may indicate a failure and should be investigated further by the technician. This is not a POMSEE but should be used as a quick check to aid the technician in localizing the troubles in the equipment.

If any of the following checks fail to give satisfactory results, the nature of the check being performed should indicate to the technician which unit or units of the transceiver are at fault. Refer to the appropriate section of this technical manual for further aid in localizing the trouble.

b. INITIAL SETTING OF FRONT PANEL CONTROLS.

(1) Power Supply PP-2154/U.
(a) ON-OFF switch. OFF
(2) Control-Power Supply C-2691/URC.
(a) HANDSET switch. LOCAL
(3) Signal Comparator CM-126/UR.
(a) FREQUENCY SELECTOR switch. OFF
(4) Amplifier-Control AM-2062( )/URC.
(a) SIDEBAND SELECTOR switch. LSB
(b) MIC GAIN switch. Fully CCW
(5) Converter-Monitor CV-730/URC.
(a) OSC CONTROL switch. OFF
(b) OUTPUT switch. OFF
(c) METER MULTR switch. +8 db
(d) XMIT-REC-CW TEST switch. REC
(e) MONITOR switch. USB XMIT
(6) Amplifier-Converter-Modulator AM-2064/URC.
(a) AM-SSB switch. SSB
(b) TUNE-LOCAL-EXTERNAL CONTROL switch. LOCAL
(c) EXCITER RF GAIN control. Fully CCW
(d) RECEIVER RF GAIN control. Fully CW


TB1
115/230 VAC
9
F1
115/230 VAC COMMON
10
FROM INTERLOCK CIRCUIT IN POWER AMPLIFIER
8
S1 CASE INTERLOCK
K1 ON-OFF RELAY
DS1
1,3
SEE NOTE
2,4
T1
7,8
5,6
+ 1600 VOLTS DIODE RECTIFIER CR13 THRU CR44
+ 2000 VOLTS FILTER L1, C1, AND C2
F3
J1
+ 2000 VDC, 500 MA TO POWER AMPLIFIER
+ 400 VOLTS
S2
TB1
+ 400 VOLTS DIODE RECTIFIER CR1 THRU CR12
F2
+ 400 VOLTS FILTER L2
6
+ 400 VDC, 75 MA TO POWER AMPLIFIER

NOTE.

FOR 115 VAC OPERATION, JUMPER PIN 1 TO PIN 3 AND PIN 2 TO PIN 4. FOR 230 VAC OPERATION, CONNECT ONE INPUT WIRE TO PIN 1 AND ONE INPUT WIRE TO PIN 4, AND JUMPER PIN 2 TO PIN 3.

Figure 4-28. Power Supply PP-2153/U, Servicing Block Diagram

(e) Meter switch.	AGC-TGC
(7) Converter-Oscillator CV-731/URC.	
(a) BAND CHANGE switch.	BAND 2
(b) Frequency counter.	5.0010 mc
(8) Radio Frequency Amplifier AM-2061/URT.	
(a) FIL OFF-TUNE-OPERATE switch.	OPERATE
(b) PLATE switch.	OFF
(c) Band switch.	2.0 to 3.7
(d) DRIVER TUNE control.	Fully CCW
(e) PA TUNE control.	Fully CCW
(9) Antenna coupler remote control unit.	
(a) LOAD/ANT switch.	LOAD
(b) REFLECTED-FORWARD switch.	FORWARD 1000
(c) CAPACITOR switch.	Shunt 1
(d) COIL switch.	Center
(e) TAP switch.	Center
(f) Coil dial.	100
(g) Tap dial.	100

c. BLOWER INTERLOCK SWITCH.

(1) Turn the low-voltage power supply (PP-2154/U) ON-OFF switch to the ON position.

(2) The blower motor should start, and after a slight delay, the red power indicator lamp should glow, indicating the closure of the air interlock switch which energizes the low-voltage power supply.

(3) If lamp fails to glow after the blower is energized, check the air filter as it must be kept clean.

(4) If the indications in step (2) are normal, block the air intake to the transceiver by placing a sheet of paper or cardboard over the air intake filter which is located directly below the low-voltage power supply at the bottom of the rack mount. When the air passage through the filter is thus blocked, the red power ON indicator lamp on the low-voltage power supply should extinguish, although the blower will continue to run.

(5) Remove the air blockage. The power or indicator lamp should light.

(6) If the proper indications mentioned in steps (4) and (5) can not be obtained, the air interlock switch is probably defective, and further investigation will be necessary.

d. LOW-VOLTAGE MEASUREMENTS.

(1) Place the meter switch on the sideband generator (AM-2064/URC) in the -90 position. The meter should indicate approximately 40 db.

(2) Repeat step (1) for the +130 and +250 meter switch positions.

e. FREQUENCY ACCURACY CHECK OF REFERENCE OSCILLATOR AND SMO.

Note

Allow a warmup period of approximately 15 minutes before making the following frequency accuracy check.

(1) Depress the OPERATE-TUNE switch on the frequency generator (CV-731/URC) to the TUNE position, and note the AFC meter indication of the frequency generator. The meter should indicate zero (midscale position).

(2) Release the OPERATE-TUNE switch to the OPERATE position and again note the AFC meter indication. The AFC meter should indicate either to the right or left of midscale position. This deviation from midscale may be from a fraction of a dial division to a maximum of 90 ua. The meter needle should be steady and free of jitters.

(3) If the reading on the AFC meter exceeds 90 ua or is unstable, one of the following modules may be defective: the SMO, the frequency divider, the sidestep oscillator, or the reference oscillator. Refer to Converter Oscillator-CV-731/URC trouble-shooting section (paragraph 4-3c) of this technical manual.

Note

When setting up an operating frequency on the frequency control group, after locking the dial on the desired frequency, always momentarily depress the OPERATE-TUNE switch to ensure proper lock in of the SMO.

(4) Make sure the frequency counter dial should be set for 5.0010 mc as set forth in paragraph 4-4b(7)(b).

(5) Listen for a 1-kc audio tone at the dynamic handset. If WWV can be received in the equipment location, a 1-kc audio tone should be audible at the dynamic handset. This is due to hetrodyning of WWV carrier frequency against the reinserted carrier frequency of the AN/URC-32( ). Any frequency deviation of the 1-kc tone will be indicative of the frequency error of the AN/URC-32( ) plus a slight error due to doppler shift of the receiver carrier.

(6) Turn the FREQUENCY SELECTOR switch on Signal Comparator CM-126/UR to the 1KC position, and adjust the METER ZERO and GAIN control to provide a visual sweep on the meter. If the AN/URC-32( ) is on frequency, a slow steady sweep should be obtained on the meter. This sweep indicates the AN/URC-32( ) frequency error in cycles per second at the received frequency, in this case WWV at 5.000 mc. For example, if a sweep of 1 cps is obtained, this would indicate an error of 1 cycle at 5 mc. However, if a comparison is made against WWV at 10.0000 (dial reading at 10.0010 mc), the sweep on the CM-126/UR should increase to 2 cps because at 10.000 mc, there would be an error of 2 cycles.

Note

A formula for computing the frequency difference between the AN/URC-32( ) and the transmitted frequency standard is given in paragraph 4-3c(1)(a)4.

f. CONVERTER-MONITOR CV-730/URC UNIT CHECK.

(1) Turn the FREQUENCY SELECTOR switch on the CM-126/UR to the OFF position.

(2) Turn the MONITOR switch on the CV-730/URC to USB REC position.

(3) Turn the OSC CONTROL switch on the CV-730/URC to the FSK position.

(4) Tune in an FSK signal on the AN/URC-32( ) by adjusting the FREQUENCY CHANGE control on Converter-Oscillator CV-731/URC.

(5) Vary the BFO control on the CW and FSK unit (CV-730/URC). (This should charge the frequency of the audible signals at the dynamic handset.)

(6) Turn the XMIT-REC-CW TEST switch on the CV-730/URC to XMIT.

(7) Advance the OUTPUT control on the CV-730/URC, and ensure that the FSK oscillator will provide over 70 db output indication on the monitor meter.

(8) Turn the OSC CONTROL switch on the CV-730/URC to CW 1KC and the XMIT-REC-CW TEST switch to CW TEST.

(9) Advance the OUTPUT control to ensure a monitor meter indication of greater than 0 db output from the CW oscillator.

(10) Intermittently key at a CW rate. The transmitter should remain keyed (green XMIT light remains on) between key rate. If not, adjust CW KEYING RELEASE TIME potentiometer, under the CV-730/URC dust cover, for a fallout time of approximately 0.5 second.

(11) Repeat steps (8) through (10) for the OSC CONTROL switch set for CW 1.5KC.

(12) Turn the OSC CONTROL switch on the CV-730/URC to the OFF position.

(13) Return the XMIT-REC-CW TEST switch to REC.

g. RADIO FREQUENCY AMPLIFIER AM-2061/URT UNIT CHECK.

(1) Turn the TUNE-LOCAL-EXTERNAL CONTROL switch on the AM-2064/URC to the LOCAL position.

(2) Turn the EXCITER RF GAIN control on the sideband generator (AM-2064/URC) fully CCW.

(3) Turn the PLATE switch on the power amplifier (AM-2061/URT) to the ON position.

(4) Turn the XMIT-REC-CW TEST switch, on the CV-731/URC, to the XMIT position. An indication of 150 ma static plate current should be observed on the PLATE CURRENT meter of the power amplifier. If this value of plate current is not present, adjust the PA BIAS potentiometer (located behind the button just above the DRIVER TUNE control) to obtain the 150-ma static plate current.

(5) Alternately operate PL NO. 1/TEST and PL NO. 2/TEST switches on the power amplifier. Observe the indications presented on the PLATE CURRENT meter. The readings should be between 60 and 90 ma in each instance. If this result is not obtained, change the PA tubes to obtain a closer balance.

Note

The power amplifiers (AM-2061/URT) of Radio Sets AN/URC-32A and AN/URC-32B have screen-voltage adjustment potentiometers located on the back panel and adjustment of these controls may deem the replacement of the PA tubes unnecessary.

(6) Unkey the transmitter and turn the PLATE switch to the OFF position.

Note

If 4CX-250R or 7580W tubes are not available, then 4X-150B tubes may be used for power amplifiers in an emergency. If 4X-150B tubes are used, set the PA BIAS control to obtain 100 ma of static plate current with no drive into the power amplifier.

h. R-F TUNER MODULE GAIN CHECK.

(1) Set the BAND CHANGE switch on the frequency generator (CV-731/URC) to BAND 1, and set the frequency dial to 1.7000 mc.

(2) Turn the TUNE-LOCAL-EXTERNAL CONTROL switch, on the sideband generator (AM-2064/URC), to TUNE and the meter switch to RF OUT EXCITER.

(3) Throw the CW TEST switch on the CV-730/URC to the XMIT position.

(4) Advance the EXCITER RF GAIN control on the sideband generator to ensure a minimum of 40 db output as indicated on the unit meter.

(5) Unkey the transmitter and turn the BAND CHANGE switch on the frequency generator (CV-731/URC) to the band 2 position.

(6) Key the transmitter and turn up the EXCITER RF GAIN control on the sideband generator and ensure that a minimum of 40 db output is again obtained.

(7) Repeat steps (5) and (6) for BAND CHANGE switch settings of 3 and 4.

(8) After checking band 4 output on the low end, leave the exciter keyed, and rotate the FREQUENCY CHANGE control, on the CV-731/URC, across the entire band to ensure a minimum of 40 db output.

(9) Check bands 1, 2, and 3 at the high end also.

(10) Unkey the transmitter.

i. SIDESTEP OSCILLATOR CHECK.

(1) Turn the BAND CHANGE control, on the CV-731/URC, to BAND 4 ADD 3. As each 1-kc step is added, the AFC meter should deflect by approximately one small increment of the scale. This indicates the proper operation of the sidestep oscillator.

(2) An alternate method of checking the sidestep oscillator is to tune in some received signal, on band 4, that will result in a tone at the dynamic handset or speaker.

(3) Change the BAND CHANGE control and ensure that the received tones change in frequency by 1 kc each time the BAND CHANGE switch setting is changed.

j. OVER-ALL TRANSMIT OPERATION CHECK.

(1) Tune the transmitter for USB operation, to a frequency near the middle of band 1, into the built-in dummy load.

(2) With the carrier inserted (TUNE-LOCAL-EXTERNAL CONTROL switch on the AM-2064/URC in the TUNE position), ensure that a 500-watt output can be obtained with 450- to 500-ma PA plate current.

(3) Reduce the power output to 125 watts with the EXCITER RF GAIN control, and turn the TUNE-LOCAL-EXTERNAL CONTROL switch to LOCAL position.

(4) Turn the AM-SSB switch to SSB position. The power output should now drop to zero watts.

(5) Return the XMIT-REC-CW TEST switch on the CV-730/URC unit to REC position.

(6) Turn the meter switch on the AM-2064/URC to the AGC-TGC position.

(7) Key the transmitter with the dynamic handset (H-169/U). Speak into the dynamic handset in normal voice tones and advance the MIC GAIN control on the AM-2062( )/URC until the meter on the AM-2064/URC indicates in the upper position of the red scale on average voice peaks. At this time, the power output meter on the PA should swing to approximately 300 watts on voice peaks.

(8) Switch the SIDEBAND SELECTOR switch on the AM-2062( )/URC to LSB position and repeat steps (1) through (7).

(9) Turn the MIC GAIN control fully CCW and the REFLECTED-FORWARD switch on the antenna coupler control unit to FORWARD 100 watts.

(10) The TUNE-LOCAL-EXTERNAL CONTROL switch on the AM-2064/URC should be in LOCAL position.

(11) Advance the EXCITER RF GAIN control fully CW.

(12) Cover the mouthpiece of the dynamic handset and key the transmitter, observe the output power meter. No output indicates that the LSB modulator is balanced properly.

(13) Repeat steps (9) through (12) with the SIDEBAND SELECTOR switch in USB position. This completes the checkout of the line amplifiers, modulators, TGC, r-f tuner module, and PA on band 1. It is only necessary now to tune the transmitter on a carrier frequency to check bands 2, 3, and 4. On one of these frequencies, check the transmitter for proper operation in AM, FSK, and CW modes of operation.

Note

In AM operation, for rated power output the carrier power should indicate about 125 watts without modulation. While checking the FSK mode of operation, patch a teletypewriter signal into the transmitter, and with the sidetone switch in the ON position, you should hear the FSK oscillator tones change from 1575 cps to 2425 cps in the headphones when inserted in the phone jack on the AM-2062( )/URC.

k. RECEIVER SENSITIVITY CHECK. - If all the previous checks give normal indications, the transceiver is probably in good condition. If the sensitivity of the receiver is in doubt, a quick check may be made by feeding a signal from R-F Signal Generator AN/URM-25F into J11 (receiver input jack), of the frequency generator (CV-731/URC). One or two microvolts input should result in a clear audible tone at the dynamic handset or phone jack.

l. ANTENNA COUPLER GROUP AN/SRA-22 CHECK.

(1) Place the TUNE-OPERATE switch of the remote control unit to TUNE position.

(2) Run the coil and tap to the low end stops by placing the COIL and TAP switches to the MIN position.

(3) Adjust COIL and TAP dials for a null indication on the respective meters. If calibration is correct, both dials should read approximately 70.

(4) Place COIL and TAP switches to MAX position, and adjust dials for a null on the respective meters. The COIL dial should read approximately 540 and the TAP dial should read approximately 470.

(5) Return both COIL and TAP dials to 100.

(6) Make sure the SERIES-SHUNT switch is in the SHUNT position.

(7) Starting from position 1 on the CAPACITOR switch, increase one step at a time through position 12. At each switch position, the capacitor run light (located below the SERIES-SHUNT switch) should come on momentarily and go out as the capacitor run motor cuts off.

(8) At CAPACITOR switch position 12, place the SERIES-SHUNT switch to SERIES position.

(9) Return the CAPACITOR switch through the 12 positions in descending numerical order to position 1, and watch the capacitor run light for an indication of capacitor tuning.

(10) If all coupler motors tune properly, tune the transmitter on a frequency and load the antenna as per tuning charts. If the antenna and coupler operate satisfactorily, the reflected power should tune out below 10 watts with 500 watts of forward power.

m. COUPLER MONITOR CU-737/URC CHECK. If a Coupler Monitor CU-737/URC is also used in the system, manually tune this unit for minimum reflected power as per instructions in the Technical Manual for Antenna Coupler Group AN/SRA-22 NavShips 93628.

SECTION 5

MAINTENANCE

5-1. FAILURE, AND PERFORMANCE AND OPERATIONAL REPORTS

Note

The Bureau of Ships no longer requires the submission of failure reports for all equipment. Failure reports and performance and operational reports are to be completed for designated equipments (refer to Electronics Installation and Maintenance Book, NavShips 900,000) only to the extent required by existing directives. All failures shall be reported for those equipments requiring the use of failure reports.

5-2. PREVENTIVE MAINTENANCE

This section of the manual (together with the Maintenance Standards Book) provides comprehensive preventive maintenance information. The tuning, adjustments, and instructions for each of the ten basic units comprising the Radio Set AN/URC-32( ) are given here. The organization of this data is similar to the organization used in section 1 through 4; that is, the data for the J-1007/U is presented first, then that for the AM-2061/URT, etc. Paragraph 5-3, Repair, is organized in the same manner.

All equipment schematics, interrack diagrams, connection diagrams, and power supply schematics are included at the end of section 5.

a. MAINTENANCE STANDARDS. - For information on maintenance standards and procedures, reference standards procedures, and periodic schedule charts, refer to the Maintenance Standards Book NavShips 93285.42A, for Radio Set AN/URC-32( ).

b. ALIGNMENT AND ADJUSTMENT. - This section provides alignment and adjustment procedures and instructions required for units of Radio Set AN/URC-32( ). Each alignment or adjustment procedure lists the test equipment required to perform that procedure. The special tools and cables supplied with Radio Set AN/URC-32( ), are included in Electrical Equipment Maintenance Kit MK-447/URC-32 and listed in table 1-4 and illustrated in figure 5-1. These special tools and cables are required for the performance of alignment and adjustment procedures.

Note

Retracking should be performed only when it has been established that misalignment (mistracking) is the cause of abnormal operation.

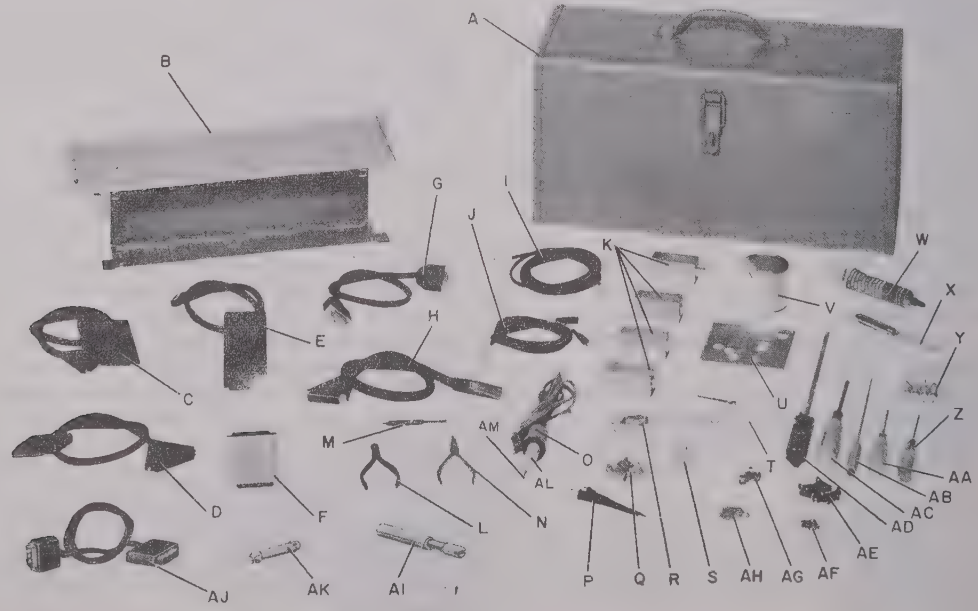


Figure 5-1. Electrical Equipment Maintenance Kit MK-447/URC-32

WARNING

Application of power to Radio Set AN/URC-32( ) results in high voltages which are dangerous to life. Observe all safety precautions.

Note

All units of the AN/URC-32( ) which require filament and plate power should be turned on at least 15 minutes prior to any alignment to allow components to reach a stable operating condition.

(1) RADIO FREQUENCY AMPLIFIER AM-2061/URT. - The equipment necessary for performing alignment and adjustment of Radio Frequency Amplifier AM-2061/URT (power amplifier) unit consists of Electronic Multimeter AN/USM-116, neutralizing capacitor wrench (part of the MK-447/URC-32 service repair tool kit), and a special alignment test circuit. The alignment test circuit must be fabricated using a pair of 220-uf r-f chokes, a 0.01-uf capacitor, and a 1N67 diode. A schematic of the test circuit connected to the vtvm (AN/URC-116) and to power amplifier DRIVER TUNE variable grid coil L4 is shown in figure 5-100.

WARNING

Voltages dangerous to life are present in this unit. Exercise extreme care while performing alignments and adjustments.

(a) BIAS VOLTAGE ADJUSTMENT. - To adjust the bias voltage, with no drive applied, place the FIL OFF-TUNE-OPERATE switch in the OPERATE position and depress PLATE switch to key and adjust the PA BIAS screwdriver adjustment on the front panel of the power amplifier for a 150-ma. indication on the PLATE CURRENT meter.

(b) NEUTRALIZATION ADJUSTMENT. - To neutralize the power amplifier proceed as follows:

1. Make sure that PLATE switch is in the OFF position and that FIL OFF-TUNE-OPERATE switch is in the FIL OFF position.

2. Remove the rear cover of the power amplifier (paragraph 5-3a(2)(b)1f), and connect the alignment test circuit to coil L4 as shown on figure 5-100.

Note

At 24 megacycles, the ground strap and bus bar are part of the inductance of L4. Therefore, solder the special test circuit leads as near the ends of the ground strap and bus bar as possible.

3. Replace the rear cover and feed the alignment test circuit output leads through the unit air hole to the vtvm. Use the 1-volt d-c scale on the vtvm.

4. Remove the dust cover and the high-voltage fuse from the associated high-voltage power supply.

5. Connect the associated exciter output to the power amplifier output (J2) and energize the power amplifier filament supply by placing the FIL OFF-TUNE-OPERATE switch in the TUNE position.

6. Tune the associated exciter for carrier output at 24 megacycles.

7. Remove the front panel, and using the neutralizing capacitor adjustment, adjust neutralizing capacitor C12 to the maximum clockwise setting.

8. Key the associated exciter, and adjust its r-f gain control for maximum output.

9. Adjust the PA TUNE and DRIVER TUNE controls for maximum voltage output on the vtvm.

10. Using the neutralizing capacitor adjustment wrench, adjust C12 for null indication on the vtvm.

11. Place FIL OFF-TUNE-OPERATE switch in FIL OFF position, and remove the special test circuit and replace the rear cover.

12. Replace the front cover and test for proper neutralization by keying the system to full power output (500 watts) at 24 megacycles, and note that maximum r-f forward power and a dip in power amplifier plate current occur simultaneously as L10 (PA TUNE) is adjusted through resonance.

13. Neutralization now is complete and should be repeated whenever new final tubes are installed.

(c) POWER AMPLIFIER TUBE BALANCE. - To balance the power amplifier tubes, proceed as follows:

1. Key the unit without drive, and adjust bias control potentiometer R19 for 150-ma total plate current.

2. Apply drive for a 400-ma total power amplifier plate current.

3. Operate the PL NO. 1 and PL NO. 2 switches to determine tube balance. Adjust screen tap switches S11 and S12 (figure 5-23), as needed, to reduce the tube currents within 10 ma of each other.

4. Remove the drive, and readjust PA BIAS control for an indication of 150-ma on the PLATE CURRENT meter.

(d) ALC ADJUSTMENT. - To adjust the automatic load control circuit proceed as follows:

1. Turn the ALC screwdriver adjustment on the front panel to the extreme clockwise.

2. Using a 1000-cps CW tone, load the power amplifier into a 50-ohm dummy load for maximum output.

3. Connect the vtvm (AN/URM-116) across the 50-ohm dummy load.

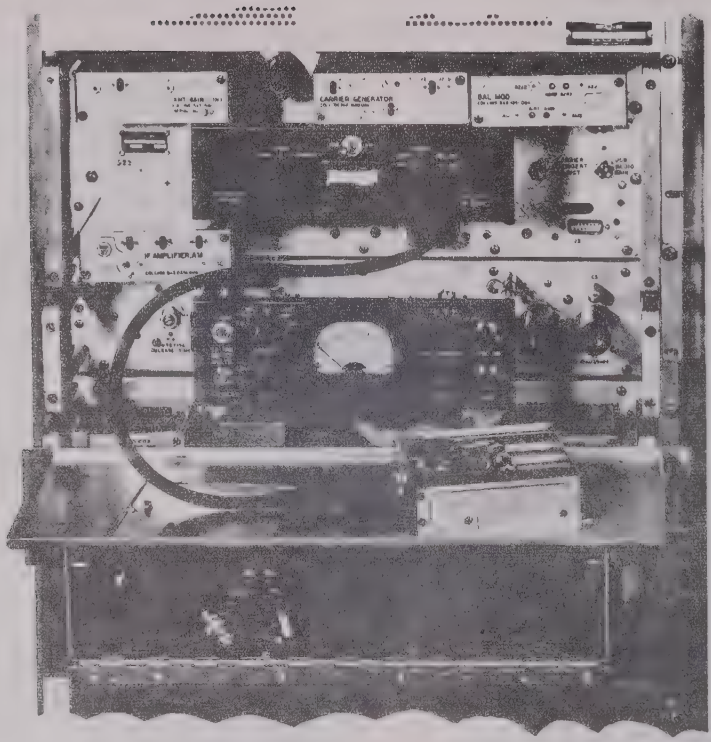


Figure 5-2. Typical Application of Module Tray and Extension Cable

4. Advance the ALC screwdriver adjustment in the counterclockwise direction until the vtvm indication decreases to 160 volts.

(e) POWER AMPLIFIER FILAMENT VOLTAGE CHECK. - Tube life is materially shortened if correct filament voltage is not maintained on V3 and V4.

1. Place the FIL OFF-TUNE-OPERATE switch in TUNE position (do not key).

2. Measure the filament voltage at the 6.0-volt test jack located on the front panel.

3. If readings of 5.7 to 6.0 volts ac are not obtained consistently, change the input tap wiring to the power amplifier filament transformer, T1, to bring the filament voltage within range. (Refer to figure 5-101.)

(2) CONVERTER-OSCILLATOR CV-731/URC. - The equipment necessary to perform alignment and adjustment of Converter-Oscillator CV-731/URC (frequency generator) is listed in table 4-5. Refer to schematic diagram figure 5-101 and use as a guide when performing the frequency generator adjustments and alignments. Each module or subassembly requiring adjustment or alignment is considered separately. Alignment of some of the modules requires use of extension cables and extension boards (figure 5-3). Use an r-f probe with the vtvm or oscilloscope whenever measurements of r-f signals or potentials are made.

WARNING

Voltages dangerous to life are present in this unit. Exercise care while performing adjustment and alignments.

(a) R-F TUNER MODULE ALIGNMENT. - Refer to paragraph 5-2a(3)(c) for removal, replacement, and mechanical alignment of the r-f tuner module. If the module has just been replaced in the unit, the mechanical alignment procedure must be performed before proceeding to step 1.

1. R-F AND I-F CIRCUIT ALIGNMENT, TRANSMIT FUNCTION. - On the sideband generator, set the TUNE-LOCAL-EXTERNAL CONTROL switch to TUNE position and the meter switch to RF OUT EXCITER position. During the following adjustments, control the signal level in the r-f tuner module so that at final peak adjustment, the meter on sideband generator reads not more than 20 db. Key the equipment to transmit condition.

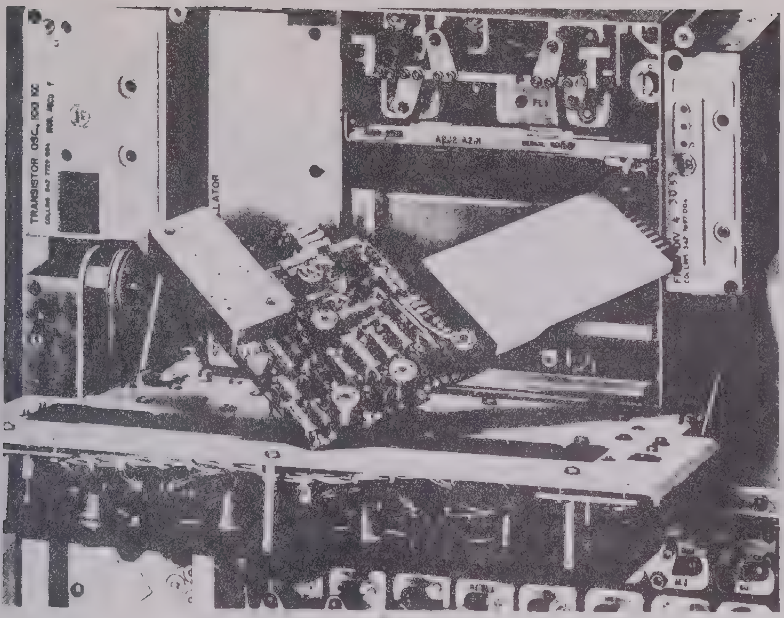


Figure 5-3. Typical Application of SMO Subassembly Extension Board

a. Refer to schematic diagram figure 5-103. Shunt Z2 and Z5 to ground through 8200-ohm resistors at J2 and J4 respectively. Set band 1 frequency dial to 1.900 mc, and adjust slugs of Z25, Z1, Z2, Z3, Z4, Z5, Z6, Z14, and Z21 for maximum indication on meter (keeping indication at approximately 20 db with EXCITER RF GAIN). Adjust the slugs in the order listed.

b. Set BAND CHANGE switch to BAND 2 (leaving FREQUENCY CHANGE control set as above). Remove the 8200-ohm resistors from J2 and J4, and peak slugs of Z7, Z8, Z15, Z18, Z19, Z20, Z22, and T1 (in that order) for maximum reading on M1 (keep indication at approximately 20 db with EXCITER RF GAIN control).

c. Set the BAND CHANGE switch to BAND 3 ADD 0 position, and peak slugs of Z28, Z9, Z10, Z16, and Z23 (in that order) using same indication and control as above.

d. Set BAND CHANGE switch to BAND 4 ADD 0 position, and peak slugs of Z26, Z27, Z29, Z30, Z11, Z12, Z13, Z17, and Z24 (in that order) using same indication and control as above.

Note

> During slug adjustments of Z26, Z27, Z28, Z29, and Z30 (bands 3 and 4), check r-f voltage at J11 with the vtvm (ME-26A/U) and r-f probe. If it is difficult to obtain 2.5 volts at this point, some of these slugs may be adjusted to the wrong harmonic of the SMO frequency. Readjust slugs to obtain peak vtvm indication at point where slug is farthest into coil.

e. Set the FREQUENCY CHANGE control so BAND 1 frequency dial shows 3.500 mc, and replace the 8200-ohm resistors from J2 and J4 to ground. Set BAND CHANGE switch to BAND 1.

f. Peak trimmer capacitors of Z25, Z1, Z2, Z3, Z4, Z5, Z6, Z14, and Z21 (in that order) for maximum meter indication of sideband generator. Using same reference, peak reading and gain control as in steps a through d. Remove 8200-ohm resistors.

g. Set the BAND CHANGE switch to BAND 2, and peak trimmer capacitors of Z7, Z8, Z15, Z18, Z19, Z20, and Z22 using same reference peak reading and gain control as in steps a through d.

h. Set BAND CHANGE switch to BAND 3 ADD 0 position, and peak trimmer capacitors of Z28, Z9, Z10, Z16, and Z23 (in that order). Set BAND CHANGE switch to BAND 2, and peak C176.

i. Set BAND CHANGE switch to BAND 4 ADD 0 KC, and peak trimmer capacitors of Z27 (C129 located at top of can; do not peak C91 at this time), Z26, Z29, Z30, Z11, Z12, Z13, Z17, and Z24 (in that order). Set BAND CHANGE switch to BAND 3, and peak C9.

j. The above alignment procedure may have to be repeated to obtain proper tracking across the band.

2. R-F AND I-F CIRCUIT ALIGNMENT, RECEIVE FUNCTION. - Since all of the tuned circuits used in receive function are also used in transmit function, except T2, align as in paragraph 5-2b(2)(d)3. Unkey and adjust T2 for maximum noise or signal. Receiver alignment is also complete.

(b) REFERENCE OSCILLATOR MODULE ALIGNMENT. - Refer to schematic diagram

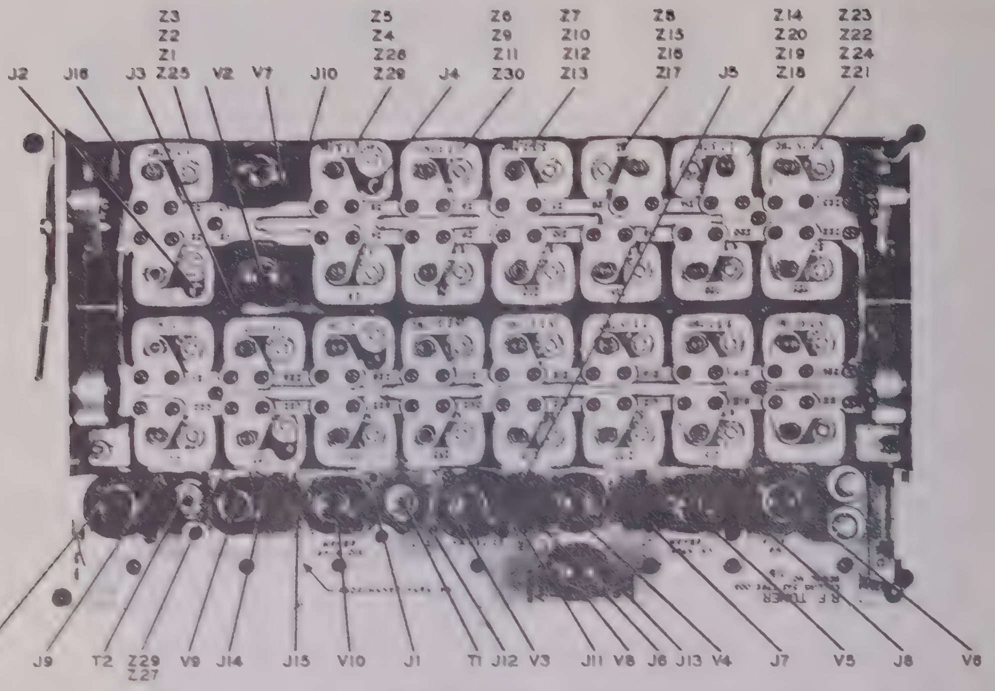


Figure 5-4. Converter-Oscillator CV-731/URC, R-F Tuner Module, Alignment Points

figure 5-109. Before alignment, allow equipment to warm up for 15 minutes. Remove reference oscillator module from chassis (paragraph 5-3a(3)(d) and connect through extension cable to chassis. Remove cover, and replace with special accessory cover which has access holes (for alignment purposes only). While cover is removed, short the collector of Q5 to ground.

CAUTION

Do not attempt alignment with cover removed. Distributed capacity provided by the cover is part of the capacity of tuned circuits. Do not make any adjustment of L1 in the 3.0-mc crystal oscillator circuit at this time. This adjustment is to be made only as a system adjustment. Align only after all trouble analysis indicates necessity.

1. Connect R-F Signal Generator AN/URM-25F through a blocking capacitor to base of Q6. Connect oscilloscope vertical input to Q7 emitter and horizontal input to Q9 emitter. Monitor the frequency with communications receiver, and set the r-f signal generator to 3.100 mc, 0.1 volt. Adjust C11 for a five-lobe Lissajous pattern on oscilloscope. Adjust r-f signal generator output to keep oscilloscope presentation on screen.

2. Set r-f signal generator to 2.900 mc (monitored in communications receiver), and adjust C26 for the five-lobe Lissajous pattern.

3. Set r-f signal generator to 3.0 mc, 0.1 volt, and check that oscilloscope presents 5-to-1 Lissajous pattern. Repeat steps 1 and 2, if necessary, moving r-f signal generator frequencies closer to 3.0 mc until the circuit divides frequency by five over the widest possible bandwidth (centered on 3.0 mc).

4. Connect the r-f signal generator and move the oscilloscope vertical input connection from Q7 emitter to pin F of P1. Set the r-f signal generator to 620 kc, and adjust C17 for a six-lobe Lissajous pattern on the oscilloscope.

5. Set r-f signal generator to 580 kc, and adjust C30 for six-lobed Lissajous pattern on oscilloscope.

6. Set r-f signal generator to 600 kc, and check that oscilloscope presents 6-to-1 Lissajous pattern. Repeat steps 4 and 5 if necessary moving signal frequencies closer to 600 kc until the circuit divides by six over the widest possible bandwidth (centered on 600 kc).

7. Remove r-f signal generator connections, and remove short from Q5 collector. Check with oscilloscope for 5-to-1 frequency division from Q7 emitter to Q9 emitter and for a 6-to-1 division from Q9 emitter to pin F of P1. Measure 2.4-mc and 100-kc outputs at P1 with r-f vtvm. Outputs should measure 1.0 to 1.5 volts rms. Remove special cover, and replace regular cover. Replace module on chassis, and secure with captive screws.

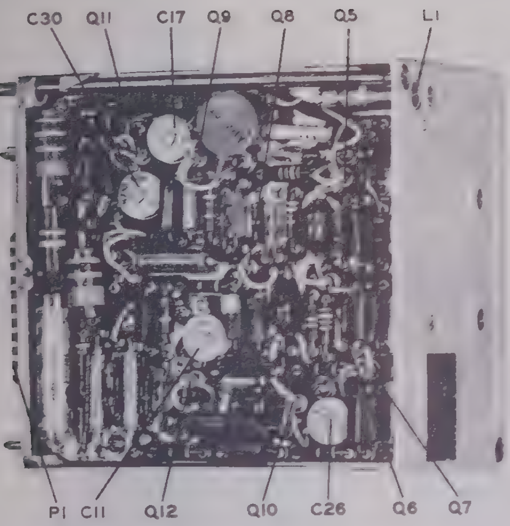


Figure 5-5. Converter-Oscillator CV-731/URC, Reference Oscillator Module, Alignment Points

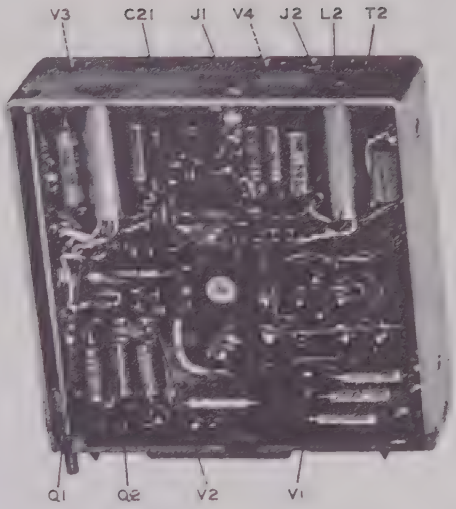


Figure 5-6. Converter-Oscillator CV-731/URC, Sidestep Oscillator Module, Alignment Points

(c) SIDESTEP OSCILLATOR MODULE ALIGNMENT. - Refer to schematic diagram in figure 5-104.

1. Place the frequency generator BAND CHANGE switch to BAND 3 ADD 1 KC.

2. Connect a vtvm (2.5-volt a-c scale) to test point J2.

3. Adjust C21, T2, and L2 for maximum indication on vtvm.

(d) 0.1-KC TUNING MODULE ALIGNMENT. - Refer to figure 5-6A.

Note

> This module is used on Radio Set AN/URC-32B only. A Radio Set AN/URC-32B which is known to be in normal operating condition is required for alignment of the 0.1-kc tuning module. Power output is not required.

1. Connect the 0.1-kc tuning module to Module Extender Cable CX-11051/URC-32, and connect the CX-11051/URC-32 to the 0.1-kc tuning module main chassis jack on Radio Set AN/URC-32B.

2. Adjust the AN/URC-32B for the transmit mode of operation. The power amplifier output is not required.

3. Set the TUNE-LOCAL-EXTERNAL CONTROL on Amplifier-Converter-Modulator AM-2064/URC to the TUNE position. Set the meter control to the RF OUT EXCITER position.

4. Turn the EXCITER RF GAIN control to the maximum clockwise position.

5. Adjust T1, T2, L1, T3, and L7 for maximum output indication on the AN-2064/URC meter. While performing this procedure, reduce the EXCITER RF GAIN control such that the output indication remains about midscale or less.

6. Adjust the AN/URC-32B for the receive AM mode of operation. Set the meter control on the AM-2064/URC to the AGC-TGC position and the TUNE-LOCAL-EXTERNAL CONTROL to the LOCAL position.

7. Connect Signal Generator AN/URM-25F to the receiver antenna, J11 on CV-731/URC. Set the CV-731/URC and the AN/URC-25F to 2,000.000 kc. The output from the AN/URC-25F should be great enough to produce a slight agc voltage on the AM-2064/URC meter.

8. Adjust L2 for peak indication on the AM-2064/URC meter.

Note

> The 0.1-kc tuning module should be allowed to warm up for approximately 30 minutes before performing the following crystal calibration procedure.

9. Connect Frequency Meter AN/USM-26 (frequency counter) to the center tap of T2 (see figure 5-6A).

10. Set 0.1-kc tuning module selector switch S1 to 0, and adjust C35 for a frequency counter reading of 213.000 kc.

11. Set selector switch S1 to 1, and adjust C29 for a frequency counter reading of 212.900 kc.

12. Set selector switch S1 to 2, and adjust C28 for a frequency counter reading of 212.800 kc.

13. Set selector switch S1 to 3, and adjust C27 for a frequency counter reading of 212.700 kc.

14. Set selector switch S1 to 4, and adjust C26 for a frequency counter reading of 212.600 kc.

15. Set selector switch S1 to 5, and adjust C25 for a frequency counter reading of 212.500 kc.

16. Set selector switch S1 to 6, and adjust C24 for a frequency counter reading of 212.400 kc.

17. Set selector switch S1 to 7, and adjust C23 for a frequency counter reading of 212.300 kc.

18. Set selector switch S1 to 8, and adjust C22 for a frequency counter reading of 212.200 kc.

19. Set selector switch S1 to 9, and adjust C21 for a frequency counter reading of 212.100 kc.

20. The alignment of the 0.1-kc tuning module is now complete. Disconnect all test equipment from the module.

(e) STABILIZED MASTER OSCILLATOR MODULE ALIGNMENT. Refer to paragraph 5-3a(3)(b) for removal and replacement of the stabilized master oscillator module (SMO). Use schematic diagram figure 5-107 as a guide while performing alignment of the SMO.

1. INTERPOLATION OSCILLATOR AND MASTER OSCILLATOR. Refer to paragraph 5-3a(3)(e) for removal and replacement of interpolation oscillator (IO) and master oscillator (MO).

a. Monitor the IO frequencies in a communications receiver to determine when the next pad is switched into the circuit in the following procedure. Connect the frequency counter to pin F of J8. Short A2J2 to ground.

b. Leave the IO shaft Oldham coupler on the shaft. Turn the IO shaft counterclockwise to lower the frequency. Set the IO at 645.4, 641.4, 637.4, 633.4, and 629.4 kc ±100 cps, and record the frequencies of the frequency counter. If the error at 645.4 kc is more or less than that at 629.4 kc, adjust A5L2 (through hole A in the IO cover) to divide the error evenly between these two points. Near zero error should occur at 633.4 kc.

c. Check the IO frequency for 625.4, 621.4, 617.4, 613.4, and 609.4 kc ±100 cps. If the error at 625.4 kc differs from that at 609.4 kc, adjust A5L7 (through hole B in the IO cover) to divide the error evenly between these two points. Near zero error should occur at 617.4 kc.

d. Check the IO frequency for 605.4, 601.4, 597.4, 593.4, and 589.4 kc ±100 cps. If the error at 605.4 kc differs from that at 589.4 kc, adjust A5L12 (through hole C in the IO cover) to divide the error evenly between these two points. Near zero error should occur at 597.4 kc.

e. Check the IO frequency for 585.4, 581.4, 577.4, 573.4, and 569.4 kc ±100 cps. If the error at 585.4 kc differs from that at 569.4 kc, adjust A5L17 (through hole D in the IO cover) to divide the error evenly between these two points. Near zero error should occur at 577.4 kc.

f. Check the interpolation oscillator frequency for 565.4, 561.4, 557.4, 553.4, and 549.4 kc ±100 cps. If the error at 565.4 kc differs from that at 549.4 kc, adjust A5L22 (through hole E in the IO cover) to divide the error evenly between these two points. Near zero error should occur at 557.4 kc.

g. Recheck the IO frequency at 645.4 kc; remove short from A2J2 to ground.

2. R-F TUNER SUBASSEMBLY ALIGNMENT. - If complete alignment is necessary, remove SMO from chassis, and connect through extension cable.

a. Turn SMO coupler (on IO shaft) clockwise to the low end stop. Check that the r-f tuner subassembly rack post on the underside of the SMO module is set about 1/16 of an inch from the bottom of the SMO chassis. If not, loosen clamp (between gear plates) on gear, driving the rack and place in this position. Tighten clamp.

b. Couple communications receiver loosely to J13, and set MO to 2.206 mc using communications receiver as frequency monitor.

Note

An alignment tool is provided in the SMO. The brass end is for alignment of FL1 of r-f tuner subassembly. The plastic end is for alignment of all other transformers and filters.

c. Short A2J2 to ground and place a-c vtvm at J13. Set r-f tuner module (not r-f tuner subassembly) to 1.906 mc. Adjust Z1 for maximum reading (1.9 to 3 volts rms).

d. Connect d-c vtvm at J2, and adjust L3 for maximum negative indication.

e. Couple communications receiver to pin 1 of V2 at a frequency of 21.1 mc. Tune Z4 and Z5 for maximum signal on communications receiver.

f. Place the vtvm (AN/USM-143) at J4 pin A; adjust slugs of Z2 and Z3 for maximum a-c indication. Touch up L3 and slugs of Z4 and Z5 for maximum a-c indication.

g. If FL1 (of this subassembly) has been replaced, peak FL1 input and output adjustments (located on bottom of chassis below XV2).

h. Set MO frequency to 3.806 mc. Set r-f tuner module to 3.506 mc, and adjust trimmer capacitor of Z1 for maximum a-c indication at J13. Adjust trimmers of Z2, Z3, Z4, and Z5 for maximum a-c indication at J4 pin A.

Note

The r-f tuner module must be set 300 kc below SMO frequency in order to align Z1, only. The remaining alignment points are independent of r-f tuner module setting.

i. The above steps may have to be repeated to obtain proper tracking across the band.

j. Remove meters. The r-f tuner subassembly now is aligned.

3. I-F MIXERS SUBASSEMBLY ALIGNMENT (MODEL A AND MODEL B SMO). -

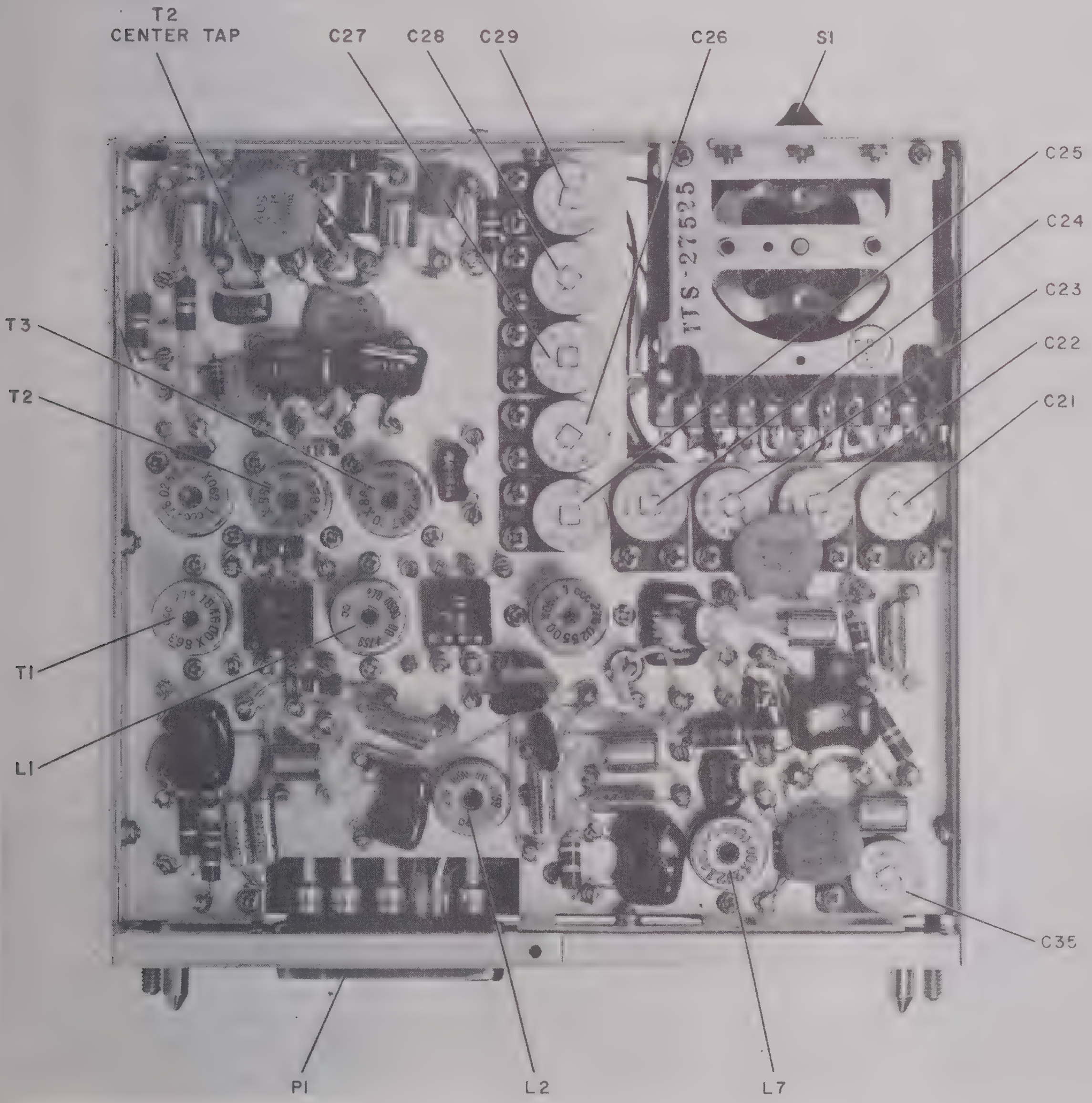

T2
CENTER TAP
C27
C28
C29
C26
S1
C25
C24
C23
C22
C21
T3
T2
T1
L1
TTS-27525
C35
P1
L2
L7

Figure 5-6A. Converter-Oscillator CV-731/URC, 0.1-Kc Tuning Module CV-1749( )/UR; Alignment Points

Remove SMO, and connect through extension cable to chassis. Remove i-f mixers subassembly and connect to SMO through extension board.

a. Connect an a-c vtvm (AN/USM-143) to terminal A of J4; adjust A3T1 for maximum indication.

b. Loosely couple the communications receiver to J13 of SMO. Turn interpolation oscillator coupler to produce interpolation oscillator frequency of 573.4 kilocycles as monitored in the communications receiver. Adjust the end points of A3FL1 (by selection of A3C5) for maximum a-c indication on the vtvm.

c. Remove meter. Replace i-f mixers subassembly and SMO.

4. I-F MIXER SUBASSEMBLY ALIGNMENT (MODEL C SMO). - Remove SMO and connect through extension cable to chassis. Remove i-f mixer subassembly and connect to SMO through extension board.

a. Connect an a-c vtvm (AN/USM-143) to terminal A of J4 on signal i-f amplifier subassembly.

b. Adjust A3T1 for maximum indication on the vtvm. Remove meter.

c. Replace i-f mixers subassembly and SMO.

5. 4-KC SPECTRUM GENERATOR ALIGNMENT. Loosely couple communications receiver antenna to J13 of SMO.

a. Connect a d-c vtvm to A7J2 (see figure 5-7) in the reference i-f amplifier board, set the IO frequency to 645.4 kc (monitored in comminications receiver), and adjust A6T1 for minimum voltage at A7J2.

b. Set the IO frequency to 549.4 kc, and adjust A6T1 for minimum voltage at A7J2.

c. Repeat steps a and b until the voltage indications are within 10 percent of each other.

6. REFERENCE I-F AMPLIFIER SUBASSEMBLY ALIGNMENT.

a. Disconnect the coaxial leads at terminals B and C of J9, and inject a 455-kc signal from an r-f signal generator through a series 22K resistor.

b. Connect a d-c vtvm to A7J2 (see figure 5-7) and increase the amplitude of injection signal until the agc voltage at A7J2 starts to decrease (point of agc threshold).

c. Using the nonmetallic end of the alignment tool, adjust A7T1, A7L2, and A7T2 for a dip in agc voltage. As each transformer is tuned, decrease the amplitude of the injection signal so that tuning adjustments are made just above agc threshold.

Note

There are two possible tuning points on each transformer. Use the tuning point with the slug farthest into the coil.

7. SIGNAL I-F AMPLIFIER SUBASSEMBLY ALIGNMENT (MODEL A SMO). - Refer to schematic diagram figure 5-105. Remove signal i-f amplifier subassembly, and connect to SMO through extension board. To remove the subassembly, swing out the unit directly above the frequency generator and insert a Phillips screwdriver through the access holes at the top of SMO module to remove the screws holding the signal i-f amplifier board. The screw on the far right of the board can be removed with an offset Phillips screwdriver.

a. Remove the straps across E1-E2 and E3-E4 on SMO module, and insert a 0-25 d-c milliammeter in each location. Connect the positive terminals of the meters to E1 and E3. Unsolder the leads to AFC meter on front panel of the frequency generator, and connect a 0-1 milliampere, zero-center milliammeter in its place to act as a differential meter. Connect vtvm for d-c operation at A[illegible]J2 of signal i-f amplifier subassembly. Unsolder coaxial lead from pin L of J4, and short pin L to ground.

b. Disconnect the coaxial cable at terminal A of J4 (or remove i-f mixers subassembly), and inject a 455-kc ±50-cps signal from R-F Signal Generator URM-25F through a series-connected 1000-ohm resistor and 0.1-uf capacitor. To obtain this degree of accuracy, the r-f signal generator must be calibrated against a known standard. Adjust level of injected signal to a value that causes a slight decrease in agc voltage at A2J2 (point of agc threshold) and output current indication appears on the output meters.

c. Adjust A2R3 for mechanical center. Make sure that the oven has been on for at least five minutes, remove oven cover, adjust A2L1 for minimum indication on the meter across E1-E2, and adjust A2L2 for minimum on the meter across E3-E4. Repeat these adjustments twice.

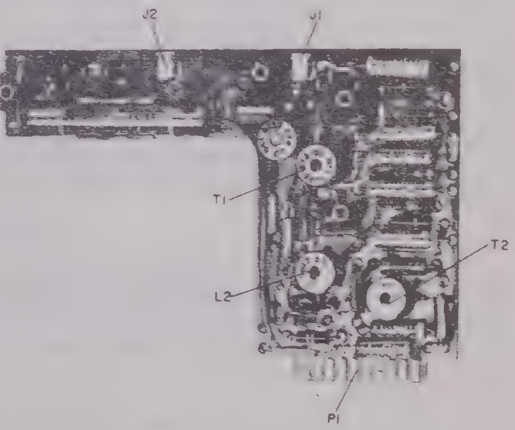


Figure 5-7. Converter-Oscillator CV-731/URC, SMO Module, Reference I-F Amplifier

d. Recheck the agc voltage, and if necessary, adjust the level of the injected signal to bring the agc voltage to just below threshold.

e. Adjust A2T1, A2T2, A2T3, and A2L3 for minimum agc voltage. Repeat at least once; then repeat adjustment of A2L1 and A2L2 in step c.

f. Change the injection frequency to 465 kc, and adjust the level to obtain an indication on the meters across E1-E2 and E3-E4.

g. Adjust A2L1 for maximum on the output meter across E3-E4. Adjust the injection level to keep this maximum below 8.0 milliamperes.

h. Change the injection frequency to 445 kc, and adjust A2L2 for maximum on the output meter across E1-E2. Adjust the injection level to keep this maximum below 8.0 milliamperes.

i. Repeat steps f, g, and h at least twice.

j. Set the injection frequency to 455 kc, 50 cps at a level of 10,000 microvolts. Adjust A2R3 for equal currents in the output meters across E1-E2 and E3-E4. Use the zero-center meter connected in place of the AFC meter for the final adjustment of A2R3. The resulting currents on the output meters should be not more than 10 milliamperes with the injection level set at 100,000 microvolts and not less than four milliamperes with the injection level set at 1000 microvolts. If the final currents (at balance) for 1000 microvolts are greater than 7.0 ma, the tuning frequencies in steps f and h must be moved closer to 455 kc, (447 and 463 kc) and the tuning procedure must be repeated until the final currents at balance are within the limits specified. Similarly, if the currents at balance for 1000 microvolts are less than 4 ma, the tuning frequencies must be moved farther from 455 kc (433 and 467 kc), and the tuning procedure must be repeated until the currents at balance are within the limits specified.

k. Set injection frequency to 457 kc at a level of 10,000 microvolts. Check for a difference reading of no less than 4 milliamperes between the two 0-25 milliammeters. Set injection frequency to 453 kc at a level of 10,000 microvolts. Check for a difference reading of no less than 4 milliamperes. If difference of 4 milliamperes cannot be obtained, repeat steps f, g, and h with tuning frequency moved closer to 455 kc (447 kc and 463 kc).

Note

There may be two possible tuning points on A2L1 and A2L2; use the tuning point with the slug farthest in from the top of the can.

l. Remove power from the frequency generator and remove the test meters. Replace jumpers on E1-E2 and E3-E4, and reconnect the AFC meter. Replace oven cover, and replace signal i-f amplifier subassembly in the SMO. Remove short from pin L of J4, and reconnect coaxial lead to pin L. Replace coaxial lead connection to pin A of J4 (replace i-f mixers subassembly).

8. SIGNAL I-F AMPLIFIER SUBASSEMBLY ALIGNMENT (MODEL B AND MODEL C SMO). - Remove signal i-f amplifier subassembly and connect to SMO through extension board. To remove the subassembly, swing out the unit directly above the frequency generator, and insert a Phillips screwdriver through the access holes at the top of the SMO module to remove the screws holding the signal i-f amplifier board. The screw on the far right of the board can be removed with an offset Phillips screwdriver.

a. Remove i-f mixers subassembly. Connect a d-c vtvm across resistor A2R25.

b. Disconnect the coaxial cable at terminal A of J4, and insert a 462.5-kc ±50 cps signal at 10 mv output from R-F Signal Generator URM-25F through a series-connected, 1000-ohm resistor and 0.1-uf capacitor. Short A7J1 test jack to ground to disable the reference i-f amplifier input to the discriminator. To obtain this degree of accuracy, the r-f signal generator must be calibrated against a known standard. Adjust A2L1 for a maximum reading on d-c vtvm.

c. Set the frequency of the r-f signal generator to 447.5 kc at 10 mv output; check against a known standard. Disconnect a d-c vtvm from A2R25 and connect across A2R26. Adjust A2L2 for a maximum indication on d-c vtvm.

d. Repeat adjustments of A2L1 and A2L2 at least once.

Note

When performing steps e and f, note which coil adjustment produces the highest reading on the d-c vtvm.

e. Set frequency of the r-f signal generator to 462.5 kc at 10 mv output, and check against a known standard. Connect d-c vtvm across A2R26, and adjust A2L1 for maximum reading on d-c vtvm.

f. Set frequency of r-f signal generator to 447.5 at 10 mv output, and check against a known standard. Adjust A2L2 for maximum reading.

g. Set frequency of r-f signal generator to 455 kc at 10 mv output, and check against a known frequency standard. The reading on the d-c vtvm should be zero. If d-c vtvm indicates unbalance, adjust r-f signal generator frequency until balance is obtained (zero on d-c vtvm). Check r-f signal generator frequency at point of balance. The frequency of r-f signal generator should be no more than plus 100 cps or minus 50 cps from 455 kc. If frequency unbalance exceeds above limits, reset frequency of r-f signal generator to 455 kc at 10 mv output, and check against a known standard. Readjust A2L1 or A2A2, whichever had produced the higher d-c vtvm reading in steps e and f, for a maximum indication.

h. Set r-f signal generator frequency at 455 kc at 10 mv output through the 1000-ohm resistor and 0.1-uf amplifier board. Short A2J3 to chassis ground to disable signal i-f amplifier board. Connect d-c vtvm across A2R28 and A2R29. Adjust A2T4 for balance (zero) as indicated on d-c vtvm.

i. Resistor A2R24 is selected to set gain of signal i-f amplifier for 1 volt rms output as measured at test jack A2J1 with an input signal of 5 microvolts. Remove R2R24 and replace with a 100-ohm potentiometer adjusted to maximum resistance. Set r-f signal generator to 455 kc, reduce output to agc threshold, and check tuning of T3 as indicated by minimum agc voltage at test jack A2J1. Remove and measure potentiometer, and select a resistor for A2R24 equal to, or slightly higher than, that measured.

j. Replace i-f mixers subassembly. Remove all meters and all grounds applied in the procedure. Replace signal i-f amplifier subassembly.

9. AFC METER AMPLIFIER SUBASSEMBLY METER BALANCE ADJUSTMENT (MODEL B AND MODEL C SMO). - Refer to schematic diagram figures 5-106 and 5-107.

a. Loosen the two captive screws, and lower the front panel of the frequency generator, connect a wire or test lead from test jack A7J2 of the stabilized master oscillator to the chassis. Connect another wire or test lead from test jack A2J2 of the stabilized master oscillator to the chassis.

b. Adjust A8R1 until AFC meter reads center scale (zero reading).

c. Remove the wire or test lead from test jacks A2J2 and A7J2.

d. Swing front panel into position, and secure with the two captive screws.

10. REPLACEMENT ALIGNMENT PROCEDURE FOR STABILIZED MASTER OSCILLATOR. - Refer to paragraph 5-3a(3)(h)2. for replacement of the SMO, and perform the following alignments each time the SMO is replaced.

a. Connect the SMO to the chassis through an extension cable, and apply power to the equipment. Short A2J2 to ground (see figure 5-8).

b. Allow a five-minute warmup. Connect vtvm (with r-f probe) to J13 (see figure 5-8).

c. Manually move the r-f tuner subassembly slug rack through its range, and leave at a position which produces maximum a-c voltage indication on the vtvm.

d. Tighten clamp on master oscillator shaft.

e. Using fingers, turn gear train so master oscillator shaft moves in clockwise direction until gear train reaches end stop. Check

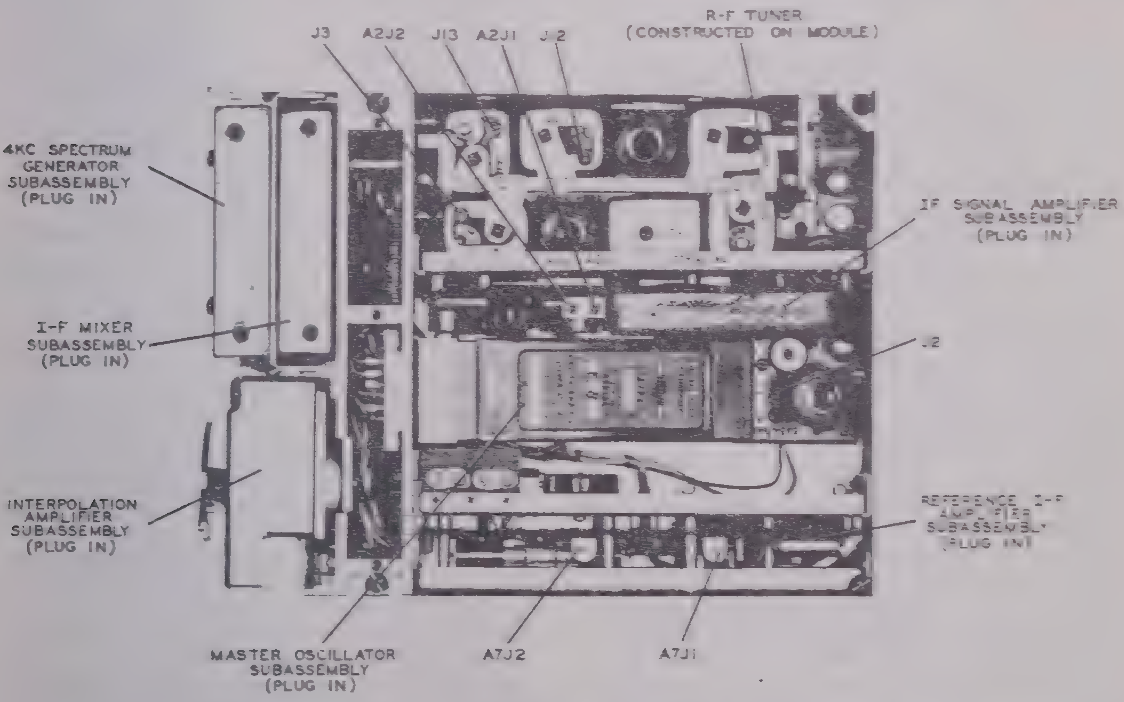

J3
A2J2
J13
A2J1
J2
R-F TUNER (CONSTRUCTED ON MODULE)
4KC SPECTRUM GENERATOR SUBASSEMBLY (PLUG IN)
IF SIGNAL AMPLIFIER SUBASSEMBLY (PLUG IN)
I-F MIXER SUBASSEMBLY (PLUG IN)
J2
INTERPOLATION AMPLIFIER SUBASSEMBLY (PLUG IN)
REFERENCE I-F AMPLIFIER SUBASSEMBLY (PLUG IN)
MASTER OSCILLATOR SUBASSEMBLY (PLUG IN)
A7J2
A7J1

Figure 5-8. Converter-Oscillator CV-731/URC, SMO Module Alignment Points and Subassembly Location

the master oscillator frequency on communications receiver by clipping antenna lead to slug rack or loosening coupling to J13. The master oscillator frequency should be 1990 kc ±5 kc.

f. If master oscillator frequency is more than 1995 or less than 1985 kc, loosen the master oscillator shaft clamp, and adjust to 1990 kc with screwdriver in slotted end of master oscillator shaft. Retighten shaft clamp.

g. Temporarily replace the interpolation oscillator subassembly, taking care to mesh gears and align plug pins properly. Tighten captive screws on interpolation oscillator.

h. Turn coupler on interpolation oscillator shaft, until ~~master~~ oscillator frequency is 2.0 mc. Mark matching index points on the coupler and interpolation oscillator cover, and turn coupler counterclockwise exactly 160 turns. The master oscillator frequency should be 4.0 mc. If not, adjust A1L2 (trimmer adjustment hole in gear plate end of master oscillator can).

i. Recheck master oscillator frequency at 2.0 mc by turning coupler exactly 160 turns clockwise. If master oscillator frequency is not 2.0 mc, loosen master oscillator shaft gear, and adjust master oscillator shaft for 2.0 mc. For small adjustments, this may be done by inserting small shaft screwdriver between gear plates and into side of slotted shaft.

j. Repeat steps h and i until master oscillator frequency range is exactly 2.0 mc with exactly 160 rotations of the interpolation oscillator shaft coupler.

k. Set master oscillator at 2.0 mc.

l. Insert a piece of insulated wire into one of the holes in the interpolation oscillator cover, and clip the communications receiver antenna to outside of insulation. Determine the interpolation oscillator frequency by tuning the receiver from 549.4 to 645.4 kc. With the master oscillator at 2.0 mc, the desired interpolation oscillator frequency is 645.4 kc.

m. If interpolation oscillator is not at 645.4 kc, move the interpolation oscillator to one side, disengage gears, and increase frequency by turning coupler clockwise 15 degrees for each 4 kc of frequency displacement from the 645.4 kc point. For example, if the interpolation oscillator frequency is 585.4 kc, the frequency displacement is 60 kc, or fifteen 4-kc increments. This requires 15 degrees times 15 increments, or 225 degrees of clockwise rotation of the shaft.

n. The interpolation oscillator frequency should now be 645.4 kc with master oscillator set at 2.0 kc. Make a pencil mark on the coupler, and rotate the coupler in both directions to the point where the oscillator frequency changes (as noted in receiver). Make a pencil mark on the interpolation oscillator cover corresponding to a mark on the coupler at each of these points; then set the coupler to a point midway between these points. Move the interpolation oscillator back into its original position. Check that the gears are engaged, and tighten the captive screws. Remove short from A2J2.

o. Turn SMO through its frequency range (2 to 4 kc) observing AFC meter on front panel of the frequency generator (CV-731/URC). Note the amount of deflection of the meter from zero (center scale). If the interpolation oscillator is in the proper position with respect to the master oscillator, the average deflection either side of zero should be equal across the band. If the average deflection is concentrated to one side or the other, the master oscillator should be disengaged by loosening master oscillator shaft gear. Turn shaft of master oscillator slightly in the direction that causes the AFC meter to move toward a balance condition. That is, if the average deflection is concentrated to the right, turn the master oscillator shaft so that the meter deflection moves to the left. Tighten the master oscillator shaft gear clamp, and recheck AFC deflection pointer deflects full scale. The interpolation oscillator may not be sitting on the proper pad, and the procedure for installing the interpolation oscillator should be repeated. If at any point across the frequency range of the SMO, the AFC meter indicates 80 ma or more, loosely couple a communications receiver to the SMO output (J13). Turn the interpolation oscillator shaft to change the SMO frequency. Distinct frequency steps should be heard (500-cps increments). If the steps are not distinct or tend to warble, this indicates that the SMO is not phase locking at this point. Loosen the master oscillator shaft gear clamp, and turn master oscillator in a direction to decrease reading of AFC meter a few microamperes. Tighten clamp and listen to SMO output around this point again. Repeat until distinct 500-cps steps are heard in the SMO output. Recheck the AFC meter excursions across the rest of the band.

(f) ISOLATION AMPLIFIER MODULE (AM-1785/GRC) ALIGNMENT.

1. Apply a 100-kc standard signal to J14 on the frequency generator chassis.

2. Connect a vtvm (10-volt a-c scale) to test point J2, and adjust C5 for maximum vtvm indication.

3. Connect test point J1 (100 kc) to the horizontal input of an oscilloscope. Connect test point J3 (600 kc) to the vertical input of the oscilloscope. Adjust C11 for a 6-to-1 Lissajous figure on the oscilloscope.

4. Connect test point J3 (600 kc) to the horizontal input of the oscilloscope. Connect test point J4 (2.4 mc) to the vertical input of the oscilloscope. Adjust C15 for a 4-to-1 Lissajous figure on the oscilloscope.

(3) AMPLIFIER-CONVERTER-MODULATOR AM-2064/URC. - The equipment necessary to perform alignment and adjustment of the Amplifier-Converter-Modulator AM-2064/URC (sideband generator) is listed in table 4-7. Refer to schematic diagram figure 5-112, and use as a guide when performing the sideband generator alignments and adjustments. Each module requiring alignment or adjustment is considered separately. Alignment of

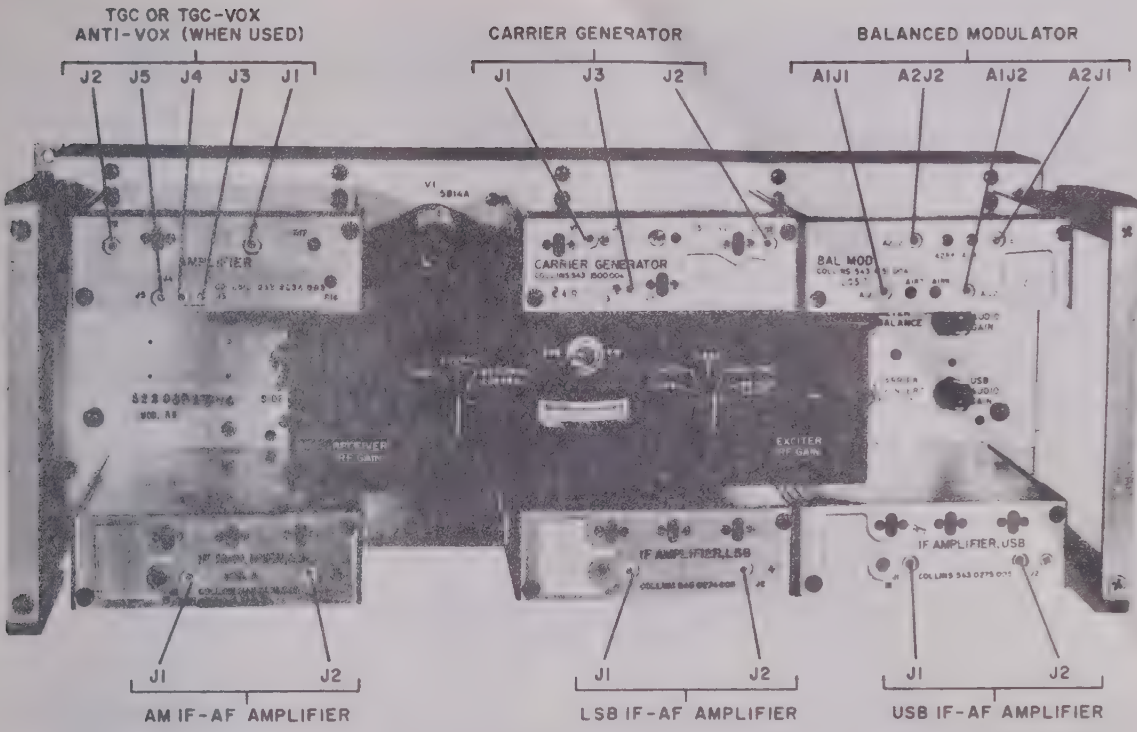

TGC OR TGC-VOX
ANTI-VOX (WHEN USED)
J2
J5
J4
J3
J1
CARRIER GENERATOR
J1
J3
J2
BALANCED MODULATOR
A1J1
A2J2
A1J2
A2J1
CARRIER GENERATOR
BAL MOD
AMPLIFIER
RECEIVER RF GAIN
EXCITER RF GAIN
IF AMPLIFIER, LSB
IF AMPLIFIER, USB
J1
J2
AM IF-AF AMPLIFIER
J1
J2
LSB IF-AF AMPLIFIER
J1
J2
USB IF-AF AMPLIFIER

Figure 5-9. Amplifier-Converter-Modulator AM-2064/URC, Test Point Location

some of the modules requires use of extension cables and extension boards (figure 5-3). Use an r-f probe with the vtvm or oscilloscope whenever measurements of r-f signals or potentials are made.

(a) CARRIER GENERATOR MODULE ALIGNMENT.

1. Connect a vtvm (AN/USM-143) to J1 on top of the carrier generator module.

2. Adjust C5 for maximum indication on the vtvm.

(b) CARRIER BALANCE ADJUSTMENT OF BALANCED MODULATOR MODULE.

1. Loosely couple the antenna of a communications receiver to the output jack of the transmitter-exciter.

2. With the power amplifier turned off, key the transmitter-exciter, and tune the communications receiver to the exciter output. Measure the agc line voltage of the communications receiver with a vtvm, or observe the S-meter indication.

3. Short A1J1 to ground.

4. Adjust potentiometers A2R7 and A2R8 until a dip in the carrier output is obtained.

5. Unbalance either potentiometer slightly (approximately one-half turn), adjust the other potentiometer for a second dip, and note the level of the carrier output.

6. Repeat the procedures of steps 4 and 5 until the lowest dip is obtained. If the carrier output increases in step 5, turn the potentiometers in the opposite direction.

Note

In the above procedure, a number of dips in the carrier output may be found depending on the potentiometer positions. However, only one setting will be found to produce the lowest dip.

7. Remove the ground from A1J1, and short A2J1 to ground.

8. Adjust A1R7 and A1R8 for minimum carrier output using the procedures in steps 4 through 8.

9. Remove the ground from A2J1. The carrier output may change slightly, either increasing or decreasing. If the carrier output increases, it may be decreased by carefully adjusting one of the four balance potentiometer.

(c) USB I-F/A-F AMPLIFIER MODULE ALIGNMENT.

1. Set i-f gain control R1 to its clockwise stop.

2. Ground the agc at test point J2.

3. Apply a 300-kc, 100 microvolt signal at J8 on the chassis.

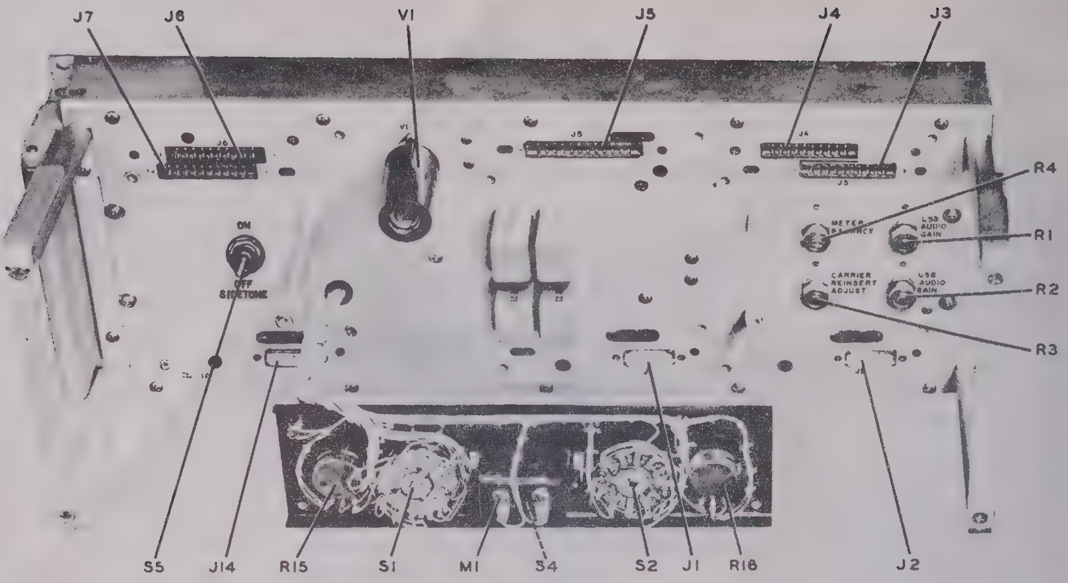


Figure 5-10. Amplifier-Converter-Modulator AM-2064/URC, Chassis, Front View

4. Adjust L1 and T1 for maximum voltage at test point J1.

5. Remove the ground from J2, and adjust T4 for maximum agc voltage at J2.

6. Adjust i-f gain control, R33, for -1.0 volt dc at J2.

(d) LSB I-F/A-F AMPLIFIER MODULE ALIGNMENT. - The LSB i-f/a-f amplifier module is identical to the USB i-f/a-f amplifier module except for the passband of the filters and the transformers. Consequently, the alignment is identical with the exception that the injection frequency for step 3 is 301.5 kc instead of 298.5 kc.

(e) AM I-F/A-F AMPLIFIER MODULE ALIGNMENT.

1. Set i-f gain control R1 to its clockwise stop.

2. Ground agc at test point J2.

3. Inject a 100-uv, 300-kc signal at J8 on the chassis.

4. Adjust L1, T1, and T2 for maximum voltage at test point J1.

5. Remove ground from J2, and adjust T5 for maximum agc voltage at J2.

6. Adjust i-f gain control, RB1, for -110 volts dc at J2.

(f) CARRIER REINSERT ADJUSTMENT.

1. Apply a 1000-cps signal to the USB input of the balanced modulator, and adjust the level for 0.5 volt at test point A1J2 on the balanced modulator module.

2. Switch the meter function switch to the RF OUT EXCITER position, and adjust the EXCITER RF GAIN control for a meter reading of 20 db.

3. Remove the 1000-cps signal applied in step a.

4. Switch the TUNE-LOCAL-EXTERNAL CONTROL switch to the TUNE position, and adjust the CARRIER REINSERT ADJUST potentiometer for a meter reading of 20 db.

5. Tighten the lock nut on the CARRIER REINSERT ADJUST potentiometer.

(g) METER BALANCE ADJUSTMENT.

1. Operate the RECEIVER RF GAIN control fully clockwise, and remove the i-f input connector from J8 on the chassis.

2. Set the meter function switch to the AGC-TGC position, and adjust the METER BALANCE potentiometer to obtain a meter reading of 10 db.

3. Tighten the lock nut on the METER BALANCE potentiometer.

(h) LSB AND USB AUDIO GAIN ADJUSTMENTS. - The following procedure is used to adjust the LSB AUDIO GAIN and USB AUDIO GAIN potentiometers. Due to a frequency inversion in the equipment, the band pass of the LSB i-f/a-f amplifier is 300 to 303 kc, and the band pass of the USB i-f/a-f amplifier is 297 to 300 kc. Therefore, in the following procedure the LSB gain is adjusted by injecting a 301.5 kc CW signal to the input of the LSB i-f/a-f amplifier, and the USB gain is adjusted by injecting the 298.5-kc CW signal to the input of the USB i-f/a-f amplifier.

1. Connect a signal generator to i-f input jack J8 on the rear of the sideband generator chassis.

2. Set the LSB and USB AUDIO OUT GAIN controls, R21 and R16 on the audio and

control unit, to maximum counterclockwise position. Set the SIDEBAND SELECTOR control to LOCAL OFF.

3. Connect the vtvm across the junction box terminal strip E, pins 3 and 4. Set the vtvm to the 10-volt a-c scale. Set the r-f signal generator to 301.5 kc CW and adjust output level to 100 uv. Adjust the r-f signal generator frequency slightly for maximum reading on vtvm. Loosen the lock nut, and adjust the LSB AUDIO GAIN potentiometer on sideband generator for a reading of 5 volts ac on the vtvm. Tighten the lock nut.

4. Connect the vtvm across the junction box terminal strip C, pins 5 and 6. Set the r-f signal generator to 298.5 kc CW, and adjust output level to 100 uv. Adjust the signal generator frequency slightly for maximum reading on the vtvm. Loosen the lock nut, and adjust USB AUDIO GAIN potentiometer for a reading of 5 volts ac on the vtvm. Tighten the lock nut.

5. Reset the audio and control unit AUDIO OUTPUT controls for line requirements. If no lines are connected, leave the controls closed. Remove the signal generator and reconnect coaxial cable to J8.

i. TGC AMPLIFIER MODULE ALIGNMENT.

1. Connect a vtvm (AN/USM-143) to test point J2 of the tgc-vox antivox module.

2. Inject a 300-kc signal to the input of the tgc amplifier module, and adjust the level for a reading of approximately 35 mv at test point J2.

3. Adjust T1 and T2 for maximum voltage at test point J2. Adjust signal injection level as necessary to maintain approximately 35 mv at test point J2.

(4) CONVERTER-MONITOR CV-730/URC. - The equipment necessary to perform alignment and adjustment of Converter-Monitor CV-730/URC (CW and FSK unit) is listed in table 4-8. Refer to schematic diagram figure 5-119, and use as a guide when performing the CW and FSK adjustments and alignments.

(a) CW KEYING RELEASE TIME ADJUSTMENT. - The CW and FSK unit is shipped with the CW keying release time set for maximum. This delay time may be reduced by adjusting the R18 CW KEYING RELEASE TIME adjustment counterclockwise. This adjustment is located under the dust cover, figure 5-11. The CW keying release time should be set so the transmitter remains keyed to transmit during normal CW key operation. This can be checked by operating the CW key at the normal rate and checking to see that the XMIT light on the CW and FSK unit remains lighted.

(b) FSK FREQUENCY ADJUSTMENT.

1. Connect output of audio oscillator to vertical input of the oscilloscope. Connect output of CW and FSK unit, pins 5 and 6 of terminal strip D, to horizontal input of oscilloscope.

2. Set OSC CONTROL switch to FSK.

3. Set audio oscillator to 2425 cps, and adjust audio oscillator output, CW and FSK unit OUTPUT control, and oscilloscope controls for a Lissajous figure on the oscilloscope. With a mark signal from the teletypewriter, adjust MARK (HI)

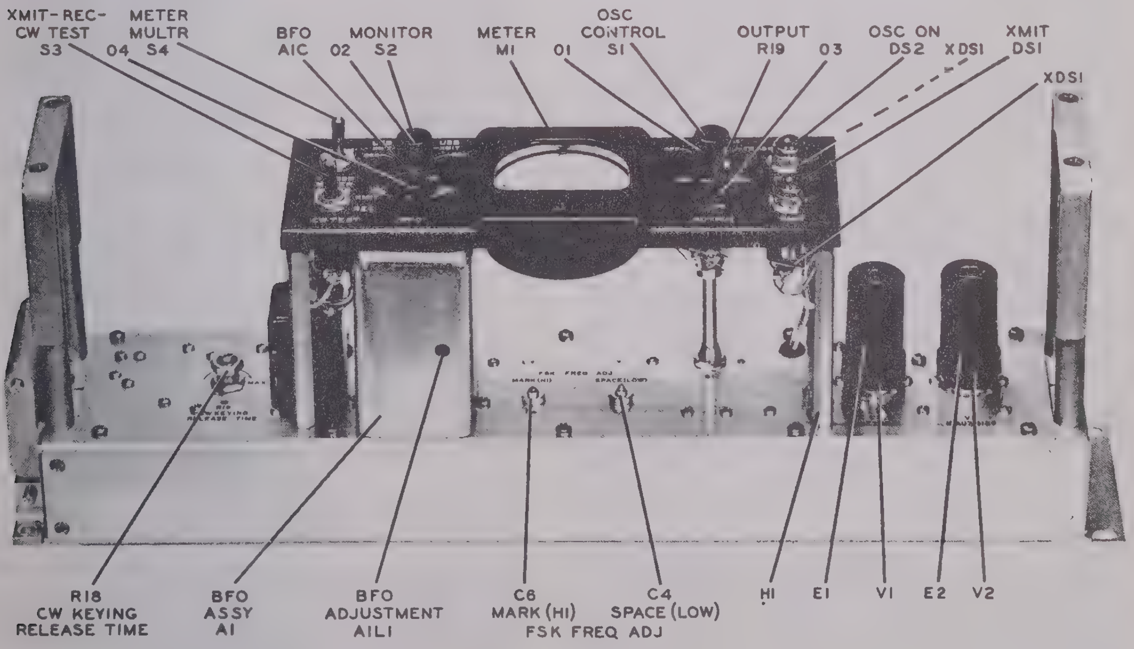


Figure 5-11. Converter-Monitor CV-730/URC, Front View with Cover Removed

FSK FREQ ADJ for a 1-to-1 Lissajous figure on the oscilloscope. If a teletypewriter is not connected to the CW and FSK unit, apply +25 volts dc to pin 12 of J1.

4. Set audio oscillator to 1575 cps. Set teletypewriter for a space signal, and adjust SPACE (LOW) FSK FREQ ADJ for a 1-to-1 Lissajous figure on the oscilloscope.

(c) BFO FREQUENCY ADJUSTMENT.

1. Remove dust cover from CW and FSK unit.

2. Connect output of audio oscillator to vertical input of oscilloscope and set to 2550 cps. Connect audio output of transceiver (phone jack) to vertical input of oscilloscope. Set frequency generator unit to 2.398 mc, and loosely couple the 2.400-mc signal present at J1 on the sidestep oscillator module to the receiver antenna (J11 on the frequency generator). Set BFO knob to center mark.

3. Set OSC CONTROL to FSK. Set XMIT T-REC-CW TEST switch to REC. Set SIDEBAND SELECTOR switch on sideband generator unit to USB. Adjust test equipment controls and the r-f gain control on the sideband generator for a Lissajous figure on the oscilloscope. Adjust A1L1 on bfo subassembly, figure 5-11, for a 1-to-1 Lissajous figure on the oscilloscope.

4. Set BFO knob to clockwise mark. Adjust audio oscillator for a 1-to-1 Lissajous figure on the oscilloscope. If audio oscillator frequency is lower than 2550 cps, the bfo frequency is adjusted properly. If the audio oscillator frequency is higher than 2550 cps, the bfo frequency is adjusted improperly and should be readjusted by repeating step 3. Improper adjustment of the bfo results from tuning the bfo to the image frequency.

(5) AMPLIFIER-CONTROL AM-2062/URC AND AM-2062A/URC. - The equipment necessary to perform alignment and adjustment of the Amplifier-Control AM-2062/URC and AM-2062A/URC (audio and control unit) consists of the audio oscillator and Electronic Voltmeter AN/USM-143.

(a) LINE LEVEL ADJUSTMENTS. (AM-2062/URC and AM-2062A/URC.) - LSB and USB LINE INPUT GAIN attenuators are adjusted to accommodate line input levels of -38 to +8 dbm. The LSB and USB LINE OUTPUT GAIN attenuators are adjusted to obtain line output levels of +14 to -34 dbm. Adjustment of these attenuators is covered under system installation in paragraph 2-6h(4).

(b) SPEAKER AMPLIFIER MODULE GAIN ADJUSTMENT. (AM-2062/URC and AM-2062A/URC.) - Potentiometer R205 provides for adjustment of the speaker amplifier module gain. The setting of this adjustment is covered under system installation in section 2.

(c) MIKE AND LINE AMPLIFIER MODULE GAIN ADJUSTMENT. (AM-2062/URC UNIT ONLY.) - Potentiometer R109 is factory adjusted for a mike and line amplifier module power gain of 40 db. If transistor Q101 or Q102 is replaced, it will be necessary to readjust R109 using the following procedure. The procedure is accomplished with the audio and control unit installed in an operating system.

1. Plug the module to be adjusted into the upper sideband line amplifier jack, J1, on the audio and control unit. All three mike and line amplifier modules are interchangeable.

2. Operate SIDEBAND SELECTOR control to LSB position. Turn USB LINE INPUT GAIN adjustment fully clockwise.

3. Apply a 10-millivolt ac, 1000-cps signal to pins 11 and 12 of terminal strip C in the junction box. Adjust R109 until 1 volt ac is obtained at test point A1J2 on the balanced modulator module in the sideband generator.

Note

If the sideband generator is not connected, place a 600-ohm load across upper sideband audio output, pins 7 and 8 on J9, and adjust R109 for 2 volts.

5-3. REPAIR.

a. REMOVAL, REPAIR, AND REPLACEMENT OF PARTS, MODULES, AND UNITS. - This subsection contains removal, disassembly, repair, reassembly, and replacement information of modules and assemblies, of Radio Set AN/URC-32( ). Replacement plug-in modules are used for rapid restoration of the equipment. When trouble isolation indicates a module is defective, or if a particular module is suspected, the module may be replaced with a spare module that has been previously checked out. The defective module then may be repaired with a minimum of downtime for the equipment. Repair procedures involve the isolation of a defective part by use of the trouble-shooting procedures of section 4 and the removal and replacement of the defective detail part.

(1) INTERCONNECTING BOX J-1007/U.

Note

Normal maintenance should not require the removal of the Interconnection Box J-1007/U (junction box). However, if removal of the junction box is required, the following procedure should be used.

(a) REMOVAL.

1. Turn power off.

2. Disconnect the cable connectors from the back of all units in the equipment rack.

3. Remove the five cable clamps from the left side of the equipment rack.

4. Disconnect the two coaxial connectors from the rear of the unit.

5. Loosen the four cross-slotted junction box mounting screws.

6. Support the unit and remove the four cross-slotted mounting screws.

Note

Use special care when removing the unit from the rack so that undue strain is not applied to the cable assembly.

7. Remove the unit from the rack and carefully lay it on a bench.

(b) DISASSEMBLY. - The following disassembly procedure can be used while the unit is installed in the equipment rack.

1. Loosen the two screw fasteners on the front panel of the unit dust cover.

2. To gain access to the thermal relay input protector, remove the eight cover plate screws.

3. Remove the thermal relay input protector cover.

(c) ASSEMBLY AND REPLACEMENT. - The assembly and replacement of the junction box is the reverse of the removal and disassembly procedure.

(2) RADIO FREQUENCY AMPLIFIER AM-2061/URT.

(a) REMOVAL.

1. Turn power off.

2. To remove Radio Frequency Amplifier AM-2061/URT (power amplifier) from the rack, remove the two screws that mount the right side of the rear panel to the rack. This will allow the power amplifier to swing out, since the left side of the unit is hinge mounted.

3. Disconnect coaxial connectors from J1, J2, J3, and plug from J6. These connectors and plug are located on the back of the power amplifier.

4. Grasp the unit firmly and remove the two screws that mount the hinge to the rack. Lay the unit carefully on a bench. To prevent damage to connector J6, the unit should not be laid on its back.

(b) DISASSEMBLY.

1. FRONT AND REAR PANELS FROM CHASSIS. - Refer to figure 5-12 for component location and proceed as follows:

a. Loosen setscrews in DRIVER TUNE knob (1), PA TUNE knob (2), and band switch knob (3). Remove the knobs.

b. Loosen the two fasteners (4) that hold plate (5) to front panel (6). Remove plate (5).

c. Remove the two screws (7) on the left bracket, which is made accessible when the plate (5) on the front panel (6) is removed.

d. Remove the fourteen binder-head screws (8) that mount the front panel (6) to the chassis.

e. Pull out and swing the front panel (6) down; be careful to avoid damage to cable and wiring to front panel (6).

f. Remove the twenty-three screws (9) that mount the back panel (10) to the unit. Remove back panel (10).

(c) ASSEMBLY AND REPLACEMENT. - The assembly and replacement of Radio Frequency Amplifier AM-2061/URT is the reverse of the removal and disassembly procedure.

(3) CONVERTER-OSCILLATOR CV-781/URC.

(a) UNIT REMOVAL.

1. To remove Converter-Oscillator CV-731/URC (frequency generator) from the rack, remove the four screws that mount the right side of the rear panel to the rack. This will allow the frequency generator to swing out since the left side of the unit is hinge mounted.

2. Disconnect coaxial connectors from J10 through J15 and plugs from J16 and J17. These connectors and plugs are located on the back of the frequency generator.

3. Release the four thumb fasteners and remove dust cover.

4. Grasp the unit firmly and remove the two screws that mount the hinge to the rack. Lay the unit carefully on a bench. To prevent damage to the connectors, the unit should not be laid on its back.

(b) REMOVING SMO MODULE.

1. Set BAND CHANGE switch (located on front panel of converter-oscillator) to band 1 and the frequency to approximately 1700 kc.

2. Loosen the two captive screws at top, and lower the control panel. This will give access to three of the modules.

3. Turn dial (with control panel lowered) so that a Bristo wrench may be inserted in the screw, securing the left half of the Oldham coupler on the drive to the SMO. Remove the coupler loading spring. Loosen the clamp on the left half of the coupler, and slide it back on the shaft.

4. Loosen the four redheaded captive screws securing the SMO to the chassis.

5. Pull the module from the chassis and carefully lay it on a bench. To prevent damage to the connectors, the SMO should not be laid on its bottom side.

(c) REMOVING R-F TUNER MODULE.

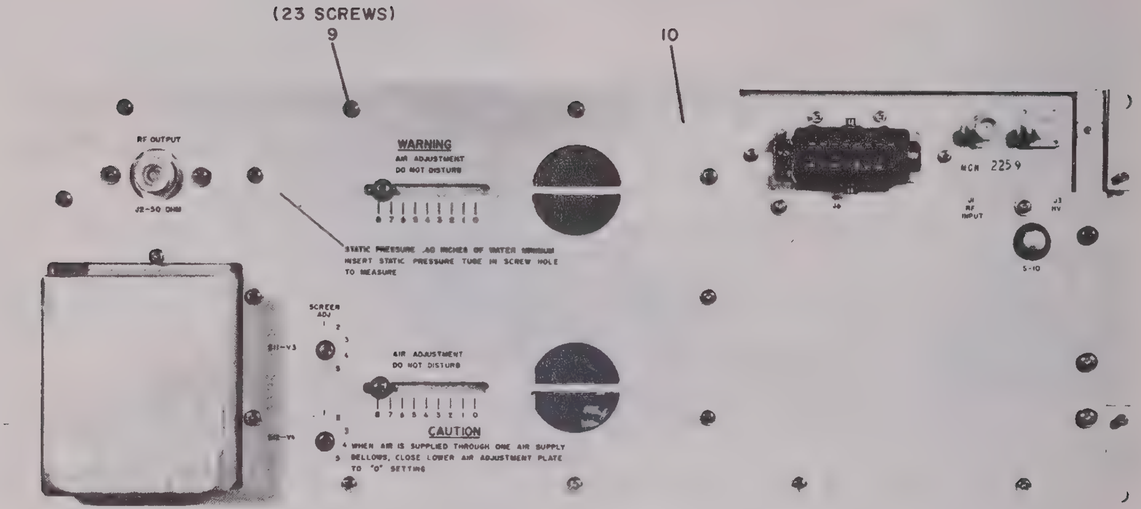
1. Loosen the left half of the Oldham coupler, and remove loading spring from left side and leave attached to right side of coupler.

2. Slide the left half of the coupler to the left, disengaging the coupler.

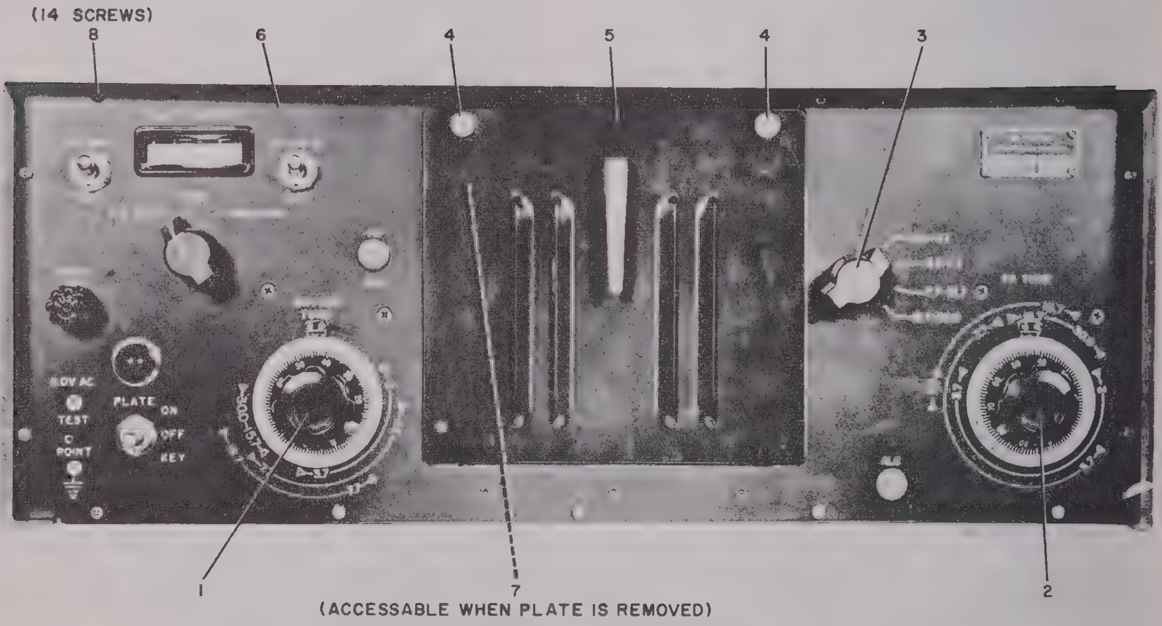
3. Loosen the four captive screws, and pull the module from the chassis and carefully lay it on a bench.

(d). REMOVING THE REMAINING MODULES FROM CONVERTER-OSCILLATOR CV-731/URC.

1. Loosen the redheaded captive screws on each module.

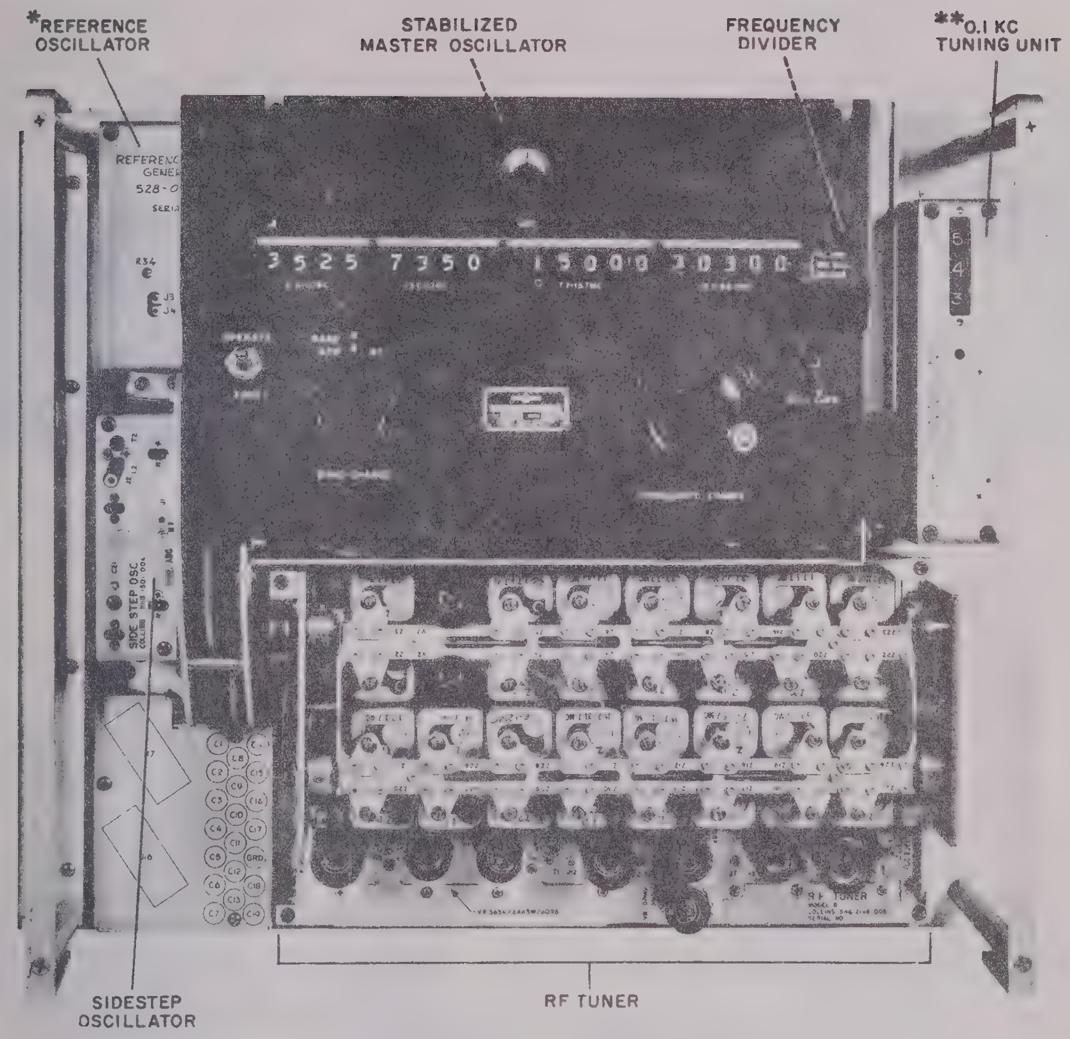

(23 SCREWS)
9
10
RF OUTPUT
J2-50 OHM
WARNING
AIR ADJUSTMENT
DO NOT DISTURB
8 7 6 5 4 3 2 1 0
STATIC PRESSURE .40 INCHES OF WATER MINIMUM
INSERT STATIC PRESSURE TUBE IN SCREW HOLE
TO MEASURE
SCREEN ADJ
1 2 3 4 5
AIR ADJUSTMENT
DO NOT DISTURB
8 7 6 5 4 3 2 1 0
1 2 3 4 5
CAUTION
WHEN AIR IS SUPPLIED THROUGH ONE AIR SUPPLY
BELLOWS, CLOSE LOWER AIR ADJUSTMENT PLATE
TO "0" SETTING
MCN 2259
J1
RF
INPUT
J3
HV
S-10

REAR VIEW


(14 SCREWS)
8
6
4
5
4
3
PLATE
ON
OFF
KEY
TEST
POINT
1
7
(ACCESSABLE WHEN PLATE IS REMOVED)
2

FRONT VIEW

Figure 5-12. Radio Frequency Amplifier AM-2061/URT
Front and Rear Views (AN/URC-32A
and AN/URC-32B VERSION)



*ISOLATION AMPLIFIER (NOT SHOWN) REPLACES REFERENCE OSCILLATOR.
**(OPTIONAL) REPLACED BY DUMMY PLUG.

Figure 5-13. Converter-Oscillator CV-731/URC, Module Location (AN/URC-32B VERSION)

2. Pull the modules from the chassis, and carefully lay them on a bench.

(e) REMOVING SMO SUBASSEMBLIES. - Refer to figure 5-15 for SMO subassembly locations.

1. Remove the SMO module (see paragraph 5-3a(3)(b). Refer to figure 5-14 and proceed as follows: Remove the seven flathead screws (1) that mount the shield cover (2) on SMO module.

2. Remove the four captive mounting screws (3) on the 4-kc spectrum generator (4), i-f mixer and signal i-f amplifier (5), and pull the subassemblies out carefully.

3. Turn the interpolation oscillator shaft (6 and 7) clockwise to the low-frequency end stop.

4. Disconnect the coaxial leads (8) from pin E (shield) and pin F (center conductor) of J8 (9) and pin D (shield) and pin E (center conductor) of J5 (10). Remove the two ties holding the coaxial leads to the standoff (11).

5. Loosen the two captive mounting screws (12) in the interpolation oscillator (6).

6. Disconnect A5P1 (13) from J7 (14). Be careful not to twist plug pins; this may damage plug. Using a small flat-bladed screwdriver, gently pry the plug and jack apart.

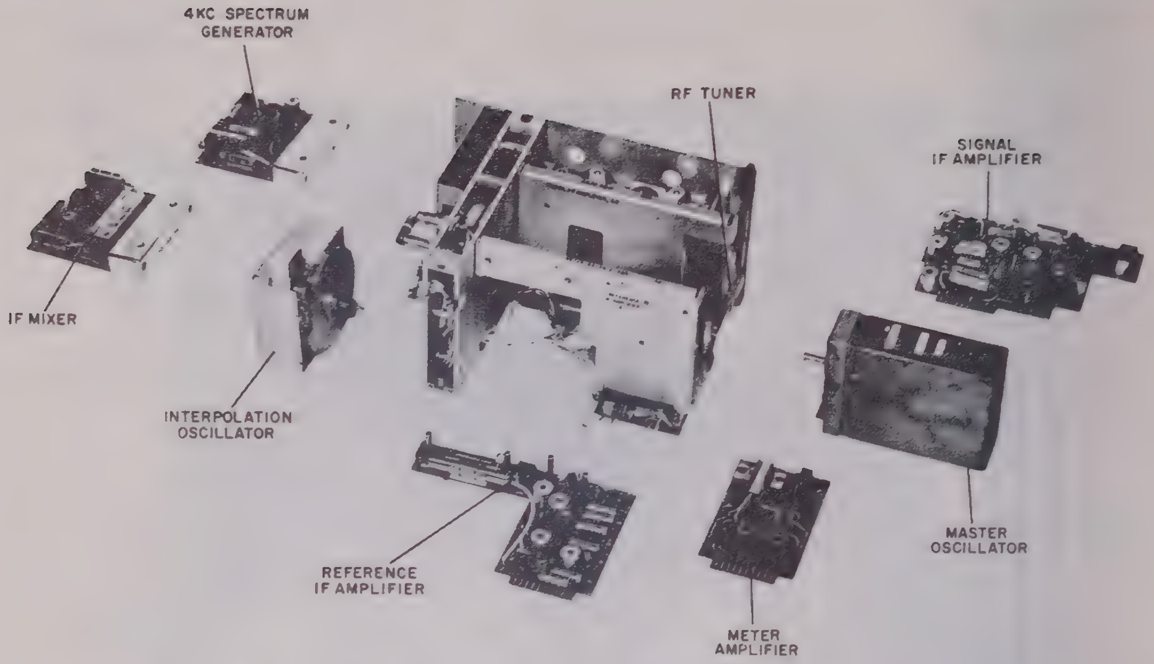


Figure 5-14. Converter-Oscillator CV-731/URC, SMO Module, Subassemblies Removed

CAUTION

No attempt should be made to disassemble the interpolation oscillator. This is a sealed unit and should be replaced as a unit if replacement is necessary.

7. To remove the master oscillator (16), remove the gear support tool (15) (secured by two screws in the upper left rear corner of the SMO module), and insert it into the large hole in the gear plate opposite the master oscillator shaft end. Align the two small wing clips on the tool with the hold notches in the gear plate, insert, and turn to lock. The small end of the plunger should be pressed against the master oscillator shaft end. This gear support tool holds the shaft gear meshed with the gear train to prevent misalignment of end-stop adjustment.

8. Loosen the Bristo screw (17) in the master oscillator shaft gear clamp. Remove the two screws securing the master oscillator to the gear plate by inserting the Bristo wrench through access holes in the gear plate (the top mounting screw also mounts a solder lug). Remove shield (19) of the tube V3 (20) and remove V3. Remove the master oscillator; make certain the plunger of gear support tool enters master oscillator shaft gear hub as master oscillator shaft is pulled out.

CAUTION

The master oscillator cover is a special material. Do not drop or strike the cover as this may destroy its shielding properties. No attempt should be made to disassemble the master oscillator. This assembly should be replaced as a unit if replacement is necessary.

9. To remove the signal i-f amplifier subassembly, refer to figure 5-15, and set the SMO in the position shown in the top view. Remove the three roundhead Phillips screws and lock washers holding the board in position. Place the Phillips screwdriver through the two holes provided at the top of the SMO frame to reach two of the screws and use the offset Phillips screwdriver provided in Electrical Equipment Maintenance Kit MK-447/URC-32 to remove the third screw on the far right-hand side of the board. Slip the board out carefully.

10. To remove the reference i-f amplifier subassembly, refer to figure 5-15 and place the SMO on the bench with the top side up. Remove the four flathead Phillips screws on the top of the right side (of SMO frame) that support the red-head captive screw bracket. Remove the one flathead screw on the top of the rear side (upper left-hand corner) that supports the bracket, and remove the bracket. Remove the four long flathead Phillips

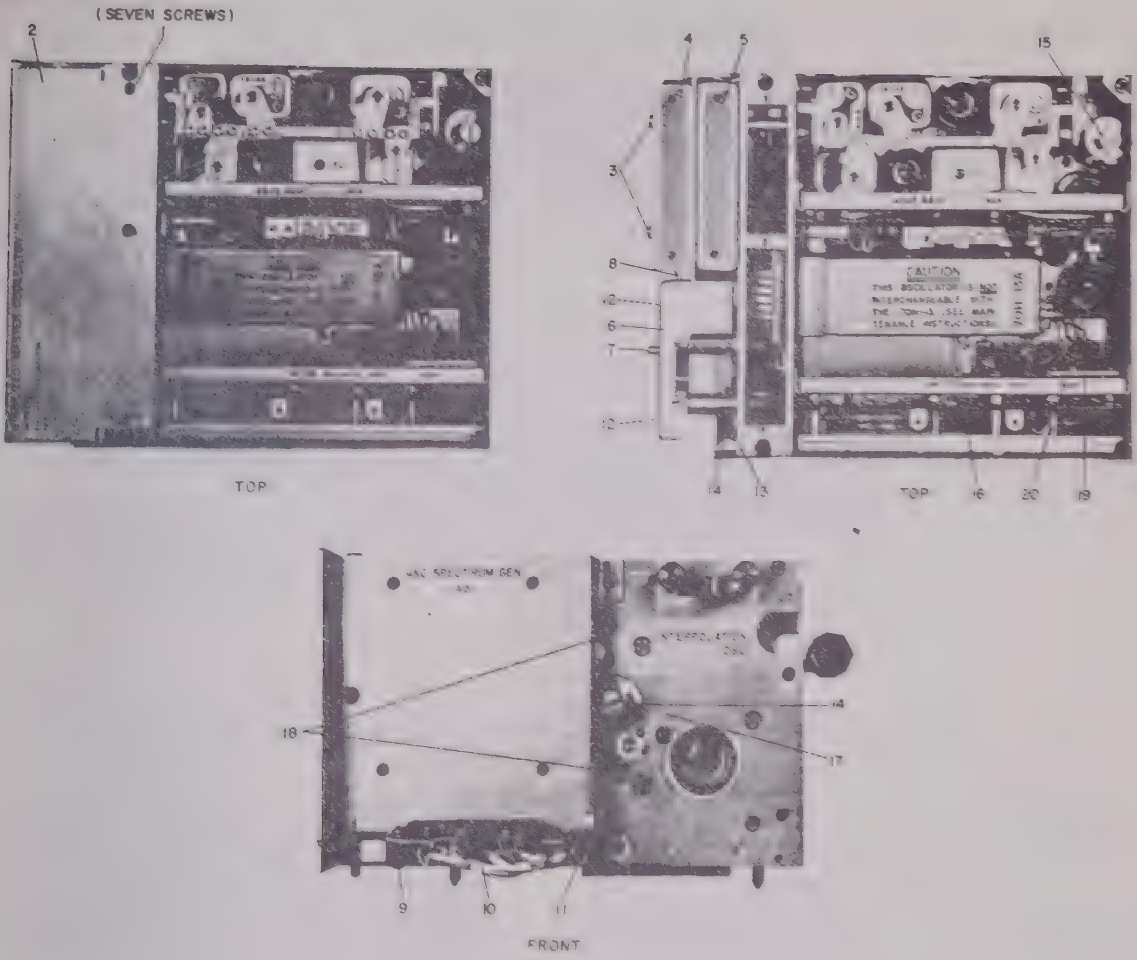


Figure 5-15. Converter-Oscillator CV-731/URC, SMO Module, Front and Top Views

screws that run through the reference i-f amplifier board from the right side. Three of these screws are located on the top edge of the right side (of SMO frame), and one is located near the middle right-hand edge of the right side of SMO frame. Remove the board carefully.

(f) REPLACING SMO SUBASSEMBLIES.

CAUTION

Exercise extreme care in replacing all modules. The printed circuit plugs on the modules can be permanently damaged by careless handling. It is possible to strip the printed circuit material from the plugs if care is not exercised.

1. MASTER OSCILLATOR. - Refer to figure 5-15 and proceed as follows:

a. Before replacing the master oscillator, turn the gear, in which the gear support tool is inserted, clockwise to the gear stop. At this point the slug rack should be all the way down (slugs all the way in).

b. To replace the master oscillator, insert the shaft through the hole in the gear plate and mate the plug and jack. Hold in place with the shaft end, pressing the spring-loaded plunger of the gear support tool, and remove gear support tool.

c. Secure the master oscillator (16) to the gear plate with the two binderhead screws (51). Do not tighten the SMO clamp at this time.

d. Place the gear support tool in its mounting clip at the rear left inside top corner of the SMO module.

e. Replace tube V3 (20) and tube shield (19).

2. INTERPOLATION OSCILLATOR. - Refer to figure 5-15 and proceed as follows:

a. Turn the interpolation oscillator (6) shaft (7) clockwise to the low-frequency end stop.

b. Carefully place the interpolation oscillator in place on the SMO gear plate engaging the gear drive with the gear train and A5P1 (14) to J7 (13) being careful not to twist plug pins.

c. Tighten the two captive screws (11) in the interpolation oscillator (6).

d. Connect the coaxial leads (8) to pin F of J8 (9) and pin D of J5 (10). Lace these two leads into the cable.

3. I-F MIXER, SIGNAL I-F AMPLIFIER, AND 4-KC SPECTRUM GENERATOR. - Refer to figure 5-15 and proceed as follows:

a. Carefully plug the i-f mixer and signal i-f amplifier (5) in place.

b. Plug the 4-kc spectrum generator (4) in place, and secure the two subassemblies with captive screws (3).

4. TESTING SMO. - Refer to paragraph 5-2b(2)(e) for testing and alignment procedures.

(g) REPLACING FRONT PANEL.

1. Swing the front panel into place; be careful not to damage the cable.

2. Secure the front panel with the eight flathead screws.

3. Place the BAND CHANGE and FREQUENCY CHANGE knobs on the shafts. The larger of the two knobs is the FREQUENCY CHANGE knob. Tighten the setscrews in each knob; be careful not to fasten the knob so close to the panel that it rubs when it is turned.

(h) REPLACEMENT OF CONVERTER-OSCILLATOR MODULES. - The replacement of the modules (except for the r-f tuner and SMO modules) is the reverse of the removal procedure outlined in paragraph 5-3a(3)(d).

1. REPLACEMENT OF R-F TUNER MODULE. - After completing steps a and b, mechanical alignment of the coupler clamp must be performed. This is covered under steps c through e.

a. To replace, move the slug rack all the way down in the r-f tuner module. Set the coupler on the turn so that the extended arm on the coupler is about 1/8-inch from the upper left hold-down screw as viewed when mounted in the chassis.

b. Mount the module on chassis, tighten captive screws, engage coupler, but leave left coupler clamp loose. Place loading spring between two coupler halves.

c. Apply power to the unit and allow a five-minute warmup.

d. Set the TUNE-LOCAL-EXTERNAL CONTROL switch on the sideband generator to TUNE position, turn EXCITER RF GAIN control to maximum, and place meter switch in RF OUT EXCITER position.

e. Key the equipment to transmit function, and move the slug rack out slowly (using extended arm on coupler as level) until the meter indicates exciter output. Reduce the EXCITER RF GAIN control if meter is pegged and then obtain a peak meter indication.

CAUTION

Be sure to adjust slug rack to the first signal indication as the slug rack is moved out. The next signal indication will be caused by the SMO frequency and will usually be stronger. If indication cannot be removed by setting TUNE-LOCAL-EXTERNAL CONTROL switch on sideband generator to LOCAL, the tuner is tuned to the wrong indication.

f. Watch indication on sideband generator meter, and tighten the left coupler clamp taking care not to move adjustment. This completes the replacement procedure.

2. REPLACEMENT OF SMO MODULE. - After completing steps a through e, mechanical alignment of the coupler clamp must be performed. This is covered under steps f through i.

Note

The following procedure is used to replace the SMO and accurately position the mechanical drive shaft with respect to the dial frequency. The procedure does not require the use of external equipment. If an accurately calibrated receiver or frequency counter is available, the SMO frequency may be monitored directly and aligned with the dial using the same procedure (the SMO frequency is used to position on instead of the converted audio signal). The SMO frequency is placed 300 kc higher than the band 1 dial reading.

a. To replace the SMO module, rotate the coupler (on SMO) clockwise to the low-frequency stop. Rotate the coupler counterclockwise exactly 57 turns. This places the SMO output frequency at approximately 2700 kc.

b. Set BAND CHANGE switch to BAND 1. Set the dial frequency of band 1 to 2400. The band 4 dial reads 21.300 mc. Align the white line at the center of the last digit on band 4 with the white line at the center of the window.

c. Lower the control panel. Plug the SMO into position, and tighten the four captive screws.

d. Engage the Oldham couplers and tighten to shaft. Raise front panel and secure.

e. Loosen gear clamp at lower right-hand corner of hinged control-panel (see figure 5-16). It may be necessary to turn FREQUENCY CHANGE knob to allow access to screw head on gear clamp. If necessary, return to original frequency setting of step e, after loosening clamp.

f. Apply power to equipment. Loosely couple the frequency generator (CV-731/

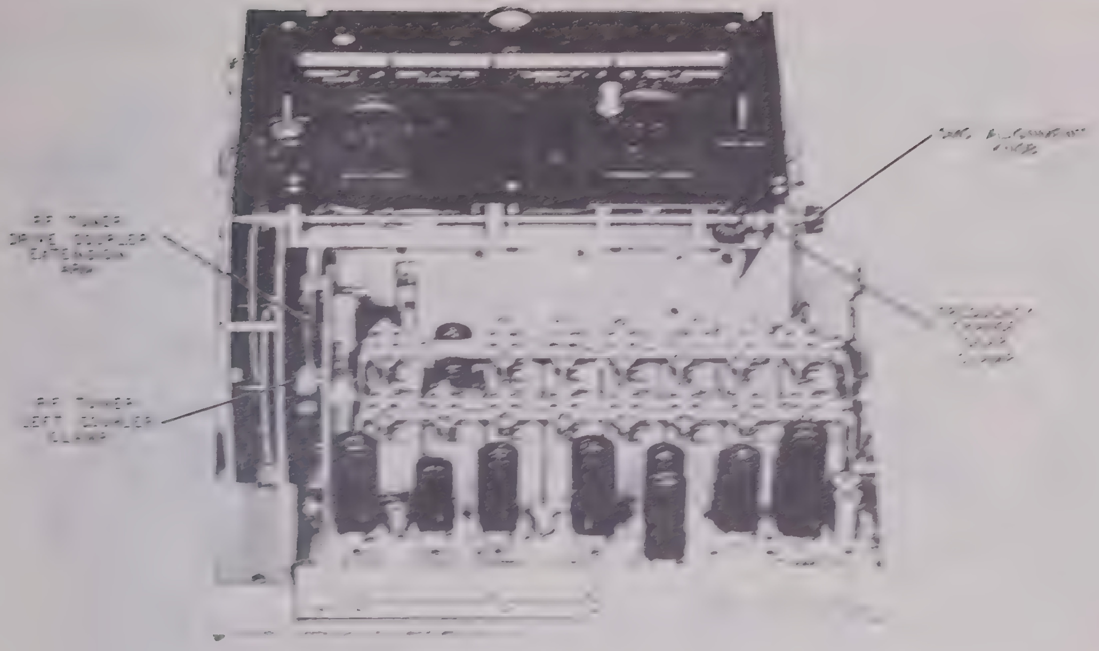


Figure 5-16. Converter-Oscillator CV-731/URC, Frequency Change
Drive Adjustments

URC) receiver input (J01 at rear) to J1 on the side-step oscillator module (2,400-mc source). Loosen left coupler clamp on r-f tuner module. The r-f tuner module must be set at a position to pass the 2,400-mc signal. If not, rotate tuner shaft with extended arm until noise is heard in the audio output.

g. While listening to the audio output on either sideband, turn SMO alignment knob (lower right-hand corner of hinged panel) until zero beat is obtained. Tighten screw on the gear clamp.

h. Listening to LSB audio output increase frequency dial setting from original position until a beat note is heard. Note distance position until a beat note is heard. Note distance of movement of the last digit in the band 4 window. Return to original position. Listen to the USB audio output, and decrease frequency dial setting until a beat note is heard and note the distance of movement as above. The distance of movement should be equal for each position. If not, repeat step g.

(d) REPLACEMENT OF CONVERTER-OSCILLATOR CV-731/URC. - The replacement of the CV-731/URC in the equipment rack is the reverse of the removal procedure outlined in paragraph 5-3a.(3)(a).

(4) AMPLIFIER-CONVERTER-MODULATOR AM-2064/URC.

(a) REMOVAL.

1. To remove Amplifier-Converter-Modulator AM-2064/URC (sideband generator) from the rack, remove the two screws that mount the right side of the rear panel to the rack. This will allow the sideband generator to swing out, since the left side of the unit is hinge mounted.

2. Disconnect coaxial connectors from J8, J9, J10, and plugs from P11, P12, and P13. These connectors and plugs are located on the back of the sideband generator.

3. Release the two Dzus fasteners, and remove dust cover.

4. Grasp the unit firmly, and remove the two screws that mount the hinge to the rack. Lay the unit carefully on a bench. To prevent damage to the connectors, the unit should not be laid on its back.

(b) REMOVING MODULES FROM AMPLIFIER-CONVERTER-MODULATOR AM-2064/URC.

1. Loosen the two red-headed captive screws on each module.

2. Pull the module from the chassis, and carefully lay them on a bench.

(c) REPLACEMENT. - The replacement of the modules in Amplifier-Converter-Modulator AM-2064/URC and the replacement of the unit in the equipment rack is the reverse of the removal procedure.

(5) CONVERTER-MONITOR CV-730/URC.

(a) REMOVAL.

1. To remove Converter-Monitor CV-730/URC (CW and FSK unit) from rack, remove the two screws that mount the right side of the rear

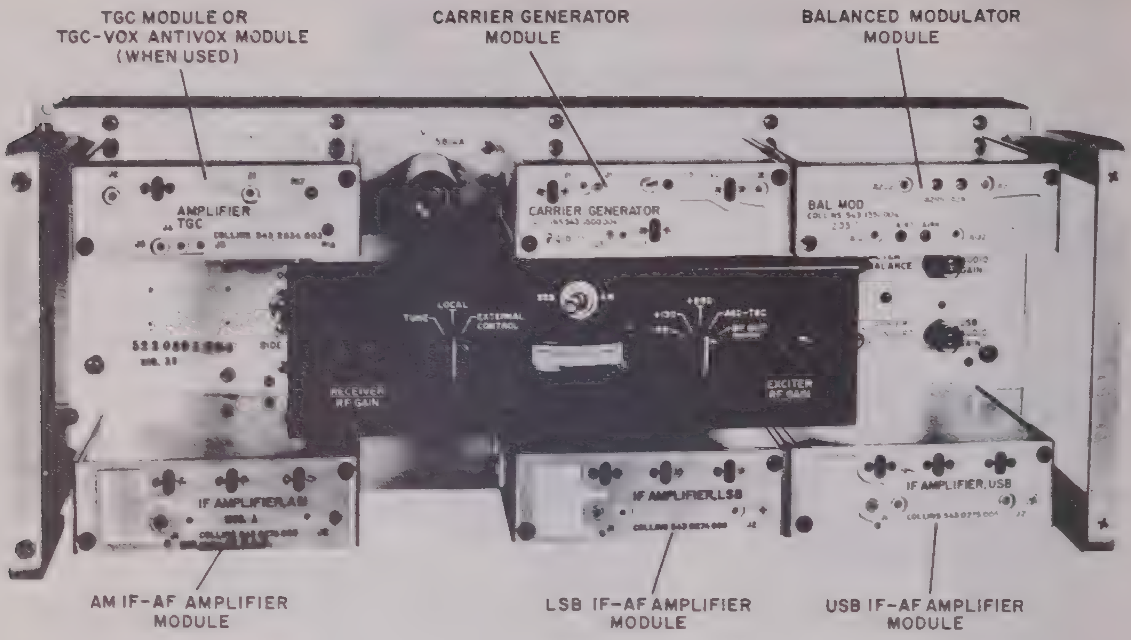

TGC MODULE OR
TGC-VOX ANTIVOX MODULE
(WHEN USED)
CARRIER GENERATOR
MODULE
BALANCED MODULATOR
MODULE
AMPLIFIER
TGC
CARRIER GENERATOR
BAL MOD
RECEIVER
RF GAIN
EXCITER
RF GAIN
IF AMPLIFIER, AM
IF AMPLIFIER, LSB
IF AMPLIFIER, USB
AM IF-AF AMPLIFIER
MODULE
LSB IF-AF AMPLIFIER
MODULE
USB IF-AF AMPLIFIER
MODULE

Figure 5-17. Amplifier-Converter-Modulator AM-2064/URC, Module Location

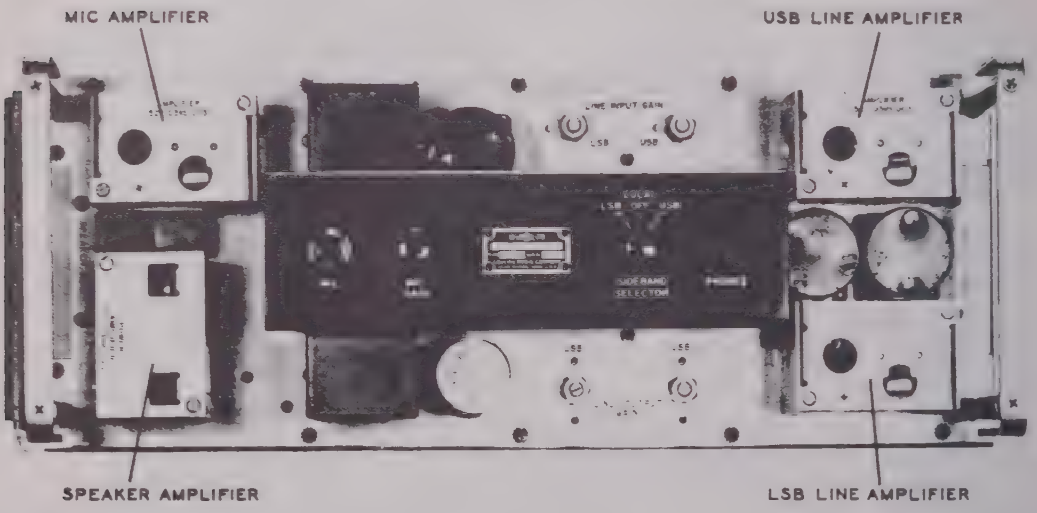

MIC AMPLIFIER
USB LINE AMPLIFIER
LINE INPUT GAIN
LSB
USB
SIDEBAND
SELECTOR
SPEAKER AMPLIFIER
LSB LINE AMPLIFIER

Figure 5-18. Amplifier-Control AM-2062/URC, Module Location
(AN/URC-32 Version)

panel to the rack. This will allow the CW and FSK unit to swing out, since the left side of the unit is hinge mounted.

2. Disconnect coaxial connectors from J2 and J3, and plug from J1. These connectors and plug are located on the back of the CW and FSK unit.

3. Release the two thumb fasteners, and remove dust cover.

4. Grasp the unit firmly, and remove the two screws that mount the hinge to the rack. Lay the unit carefully on a bench. To prevent damage to the connectors, the unit should not be laid on its back.

(b) REPLACEMENT. - The replacement of the unit is the reverse of the removal procedure.

(6) AMPLIFIER-CONTROL AM-2062/URC AND AM-2062A/URC.

(a) REMOVAL.

1. To remove Amplifier-Control AM-2062/URC or AM-2062A/URC (audio and control unit) from rack, remove the two screws that mount the right side of the rear panel to the rack. This will allow the audio and control unit to swing out, since the left side of the unit is hinge mounted.

2. Disconnect coaxial connector from J7 and plugs from J8 and J9. These plugs and connector are located on the back of the audio and control unit.

3. Release the two thumb fasteners, and remove dust cover.

(b) REMOVING MODULES FROM AMPLIFIER-CONTROL AM-2062/URC OR AM-2062A/URC.

1. Loosen the two redheaded captive screws on each module.

2. Pull the modules from the chassis, and carefully lay them on a bench.

(c) REPLACEMENT. - The replacement of the modules in Amplifier-Control AM-2062/URC or AM-2062A/URC and the replacement of the unit in the equipment rack is the reverse of the removal procedure.

(7) SIGNAL COMPARATOR, CM-126/UR.

(a) REMOVAL.

1. To remove Signal Comparator CM-126/U (frequency comparator) from rack, remove the two screws that mount the right side of the rear panel to the rack. This will allow the frequency comparator to swing out, since the left side of the unit is hinge mounted.

2. Disconnect coaxial connectors from J1 and J2, and plug from J4. This plug and the connectors are located on the back of the frequency comparator.

3. Release the two thumb fasteners and remove dust cover.

4. Grasp the unit firmly, and remove the two screws that mount the hinge to the rack. Lay the unit carefully on a bench. To prevent damage to the connectors, the unit should not be laid on its back.

(b) REPLACEMENT. - The replacement of Signal Comparator CM-126/U is the reverse of the removal procedure.

(8) POWER SUPPLY PP-2153/U.

(a) REMOVAL.

1. To remove Power Supply PP-2153/U (high-voltage power supply) from rack, remove three of the four screws from each side that mount the rear panel to the rack.

2. Release the two thumb fasteners, and remove dust cover.

3. Remove the two screws that mount the cover marked DANGER HIGH VOLTAGE over the terminal strip TB1.

4. Remove wires from terminal strip TB1, and coaxial plug from connector J1.

Note

Since the high-voltage power supply weighs 93 pounds, it should be blocked up or held by a second person when the screws are removed.

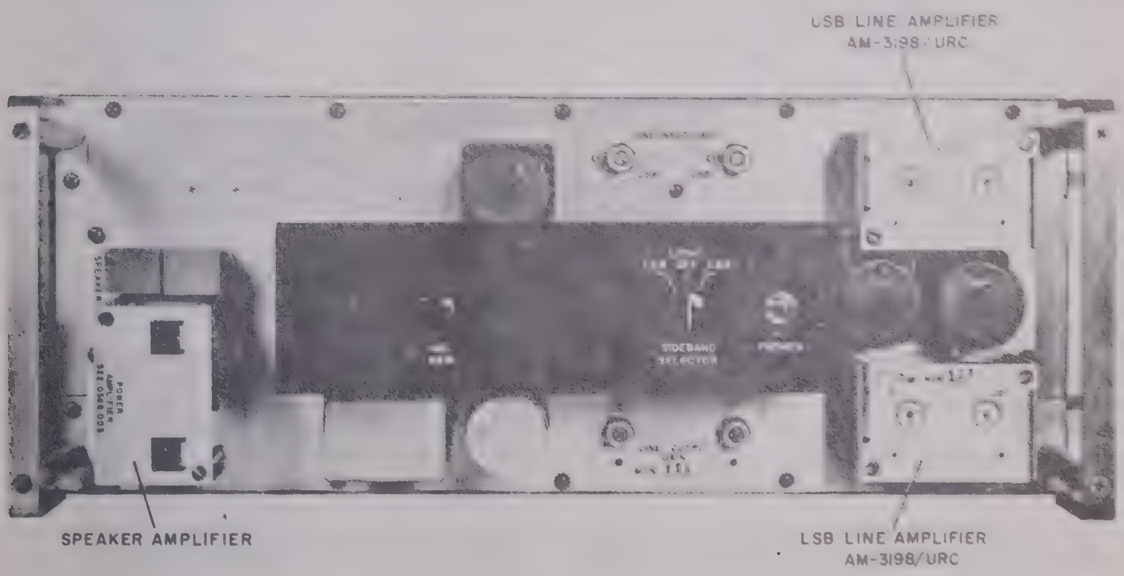


Figure 5-19. Amplifier-Control AM-2062A/URC, Module Location (AN/URC-32A and AN/URC-32B Version)

5. Grasp the unit firmly, and remove the mounting screw from each side of the unit. Lay the unit carefully on a bench. To prevent damage to the terminal strip and connector, the unit should not be laid on its back.

(b) REPLACEMENT. - The replacement of Power Supply PP-2153/U is the reverse of the removal procedure.

(9) CONTROL-POWER SUPPLY C-2691/URC.

(a) REMOVAL.

1. To remove Control-Power Supply C-2691/URC (handset adapter) from rack, remove the two screws that mount the right side of the rear panel to the rack. This will allow the handset adapter to swing out, since the left side of the unit is hinge mounted.

2. Disconnect coaxial connector from J2, and plug from J3. This connector and plug is located on the back of the unit.

3. Release the two thumb fasteners, and remove dust cover.

4. Grasp the unit firmly, and remove the two screws that mount the hinge to the rack. Lay the unit carefully on a bench. To prevent damage to the connector and plug, the unit should not be laid on its back.

(b) REPLACEMENT. - The replacement of Control-Power Supply C-2691/URC is the reverse of the removal procedure.

(10) POWER SUPPLY PP-2154/U.

(a) REMOVAL.

1. To remove Power Supply PP-2154/U (low-voltage power supply) from rack, remove the two screws that mount the right side of the rear panel to the rack. This will allow the low-voltage power supply to swing out, since the left side of the unit is hinge mounted.

2. Disconnect plug from J1 and J2. These plugs and connectors are located on the back of the low-voltage power supply.

3. Release the two thumb fasteners, and remove dust cover.

4. Grasp the unit firmly, and remove the two screws that mount the hinge to the rack. Lay the unit carefully on a bench. To prevent damage to the connectors, the unit should not be laid on its back.

(b) REPLACEMENT. - The replacement of Power Supply PP-2154/U is the reverse of the removal procedure.

(11) ELECTRONIC EQUIPMENT AIR COOLER HD-347/U.

(a) REMOVAL.

1. To remove Electronic Equipment Air Cooler HD-347/U from rack, remove the four screws that mount the air duct to the top of the air cooler.

2. Disconnect plug from connector J1. This plug is located on the top side of the unit.

3. Using a flat-bladed screwdriver, loosen the four fasteners, and remove the cover with the filter.

4. Grasp the unit firmly, and remove the two mounting screws from each side of the unit. Lay the unit carefully on a bench.

5. Loosen the two fasteners that hold the filter to the cover, and lift filter from cover.

(b) AIR FILTER CLEANING PROCEDURE. - Establish a regular cycle of cleaning the air filter based on visual inspection and experience. Always clean the filter before the air-outlet side becomes dirty. To clean the filter, gently immerse it in cool water, dirty side up, to float out dirt and lint. A gentle up-and-down motion dislodges any stubborn particles. If a large amount of grease or oil has accumulated on the filter, use a mild detergent in the water. If it is impossible to immerse the filter, pass a fine spray of water through it in the direction opposite to that of air flow. Shake gently to remove water, and replace in equipment.

CAUTION

Check the air filter at least once a week even under clean-air conditions. A dirty, clogged filter may cause the blower motor to run away and burn up.

(c) LUBRICATION. - The blower motor has sealed bearings which are lubricated for the life of the blower; therefore, no lubrication of HD-347/U is required.

(d) REPLACEMENT. - The replacement of the air cooler is the reverse of the removal procedure.

b. EMERGENCY MAINTENANCE FOR ELECTRONIC ASSEMBLIES. - None of the modular assemblies within the AN/URC-32( ) are directly interchangeable. The downtime for the equipment may be held to a minimum if spare replacement modules are available. The quick-check procedure discussed under paragraph 4-4 may be used to help locate a faulty module.

5-4. SCHEMATIC DIAGRAMS AND TEST DATA.

Although section 5 is primarily concerned with maintenance, data is included here which is useful to other sections of this manual. These data are in the form of schematic diagrams and charts on vacuum tube voltage and resistance. All schematic diagrams (intraconnection, interconnection, power distribution, and equipment) are contained at the end of section 5. The voltage and resistance charts are on the aprons of the respective schematics.

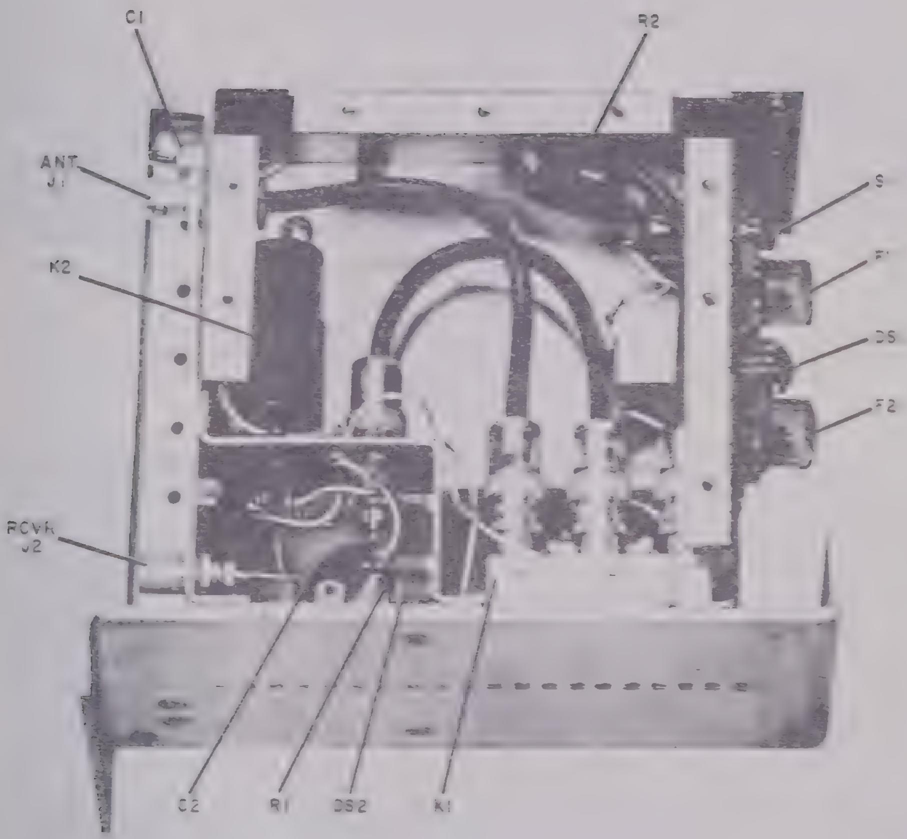

C1
R2
ANT
J1
S
K2
F1
DS
F2
RCVR
J2
C2
R1
DS2
K1

Figure 5-20. Interconnecting Box J-1007/U, Thermal Relay Input Protector, Bottom View, Cover Removed

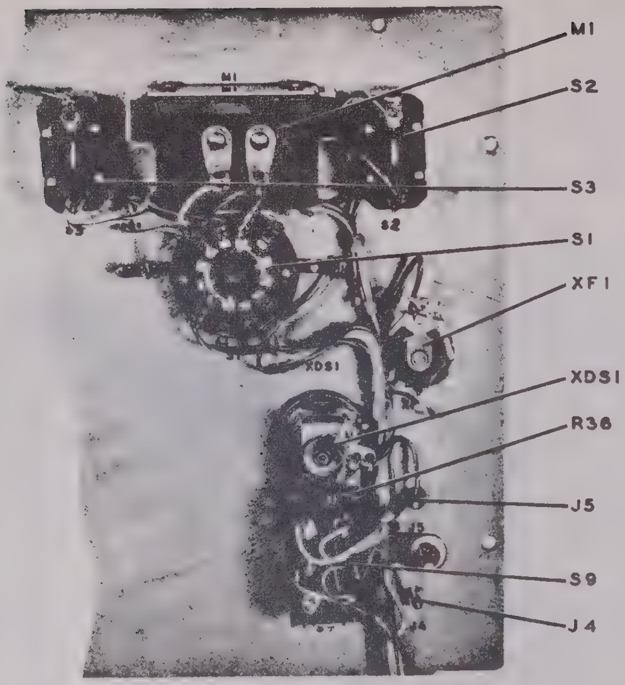

M1
S2
S3
S1
XF1
XDS1
R36
J5
S9
J4

Figure 5-21. Radio Frequency Amplifier,AM-2061/URT, Front Panel, Rear View

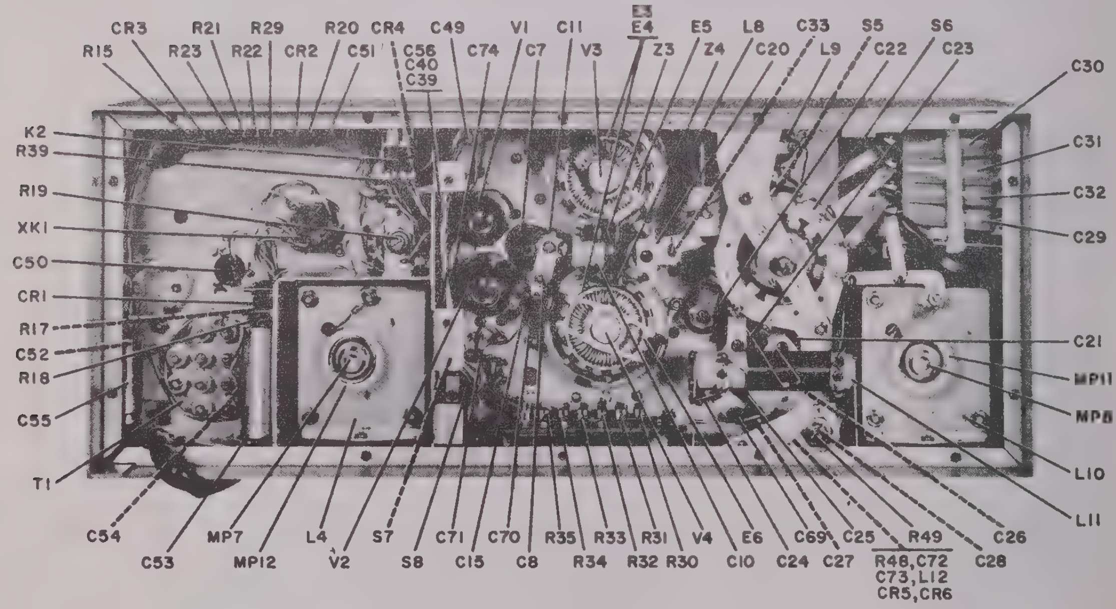

CR3
R21
R29
R20
CR4
C49
V1
C11
E3
E4
E5
L8
C33
S5
S6
R15
R23
R22
CR2
C51
C56
C40
C39
C74
C7
V3
Z3
Z4
C20
L9
C22
C23
C30
K2
R39
R19
XK1
C50
CR1
R17
C52
R18
C55
T1
C31
C32
C29
C21
MP11
MP8
L10
L11
C54
MP7
L4
S7
C71
C70
R35
R33
R31
V4
E6
C69
C25
R49
C26
C53
MP12
V2
S8
C15
C8
R34
R32
R30
C10
C24
C27
R48,C72
C73,L12
CR5,CR6
C28

Figure 5-22. Radio Frequency Amplifier AM-2061/URT, Front View, Front Panel Removed

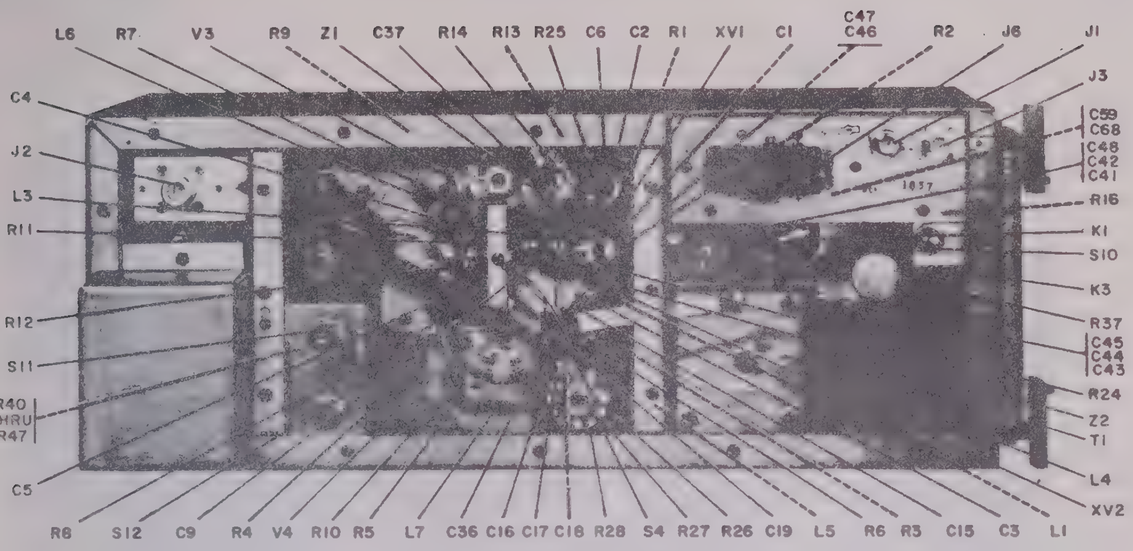

L6
R7
V3
R9
Z1
C37
R14
R13
R25
C6
C2
R1
XV1
C1
C47
C46
R2
J6
J1
J3
C4
J2
L3
R11
R12
S11
R40 THRU R47
C5
C59
C68
C48
C42
C41
R16
K1
S10
K3
R37
C45
C44
C43
R24
Z2
T1
L4
XV2
R8
S12
C9
R4
V4
R10
R5
L7
C36
C16
C17
C18
R28
S4
R27
R26
C19
L5
R6
R3
C15
C3
L1

Figure 5-23. Radio Frequency Amplifier AM-2061/URT, Rear View, Cover Removed

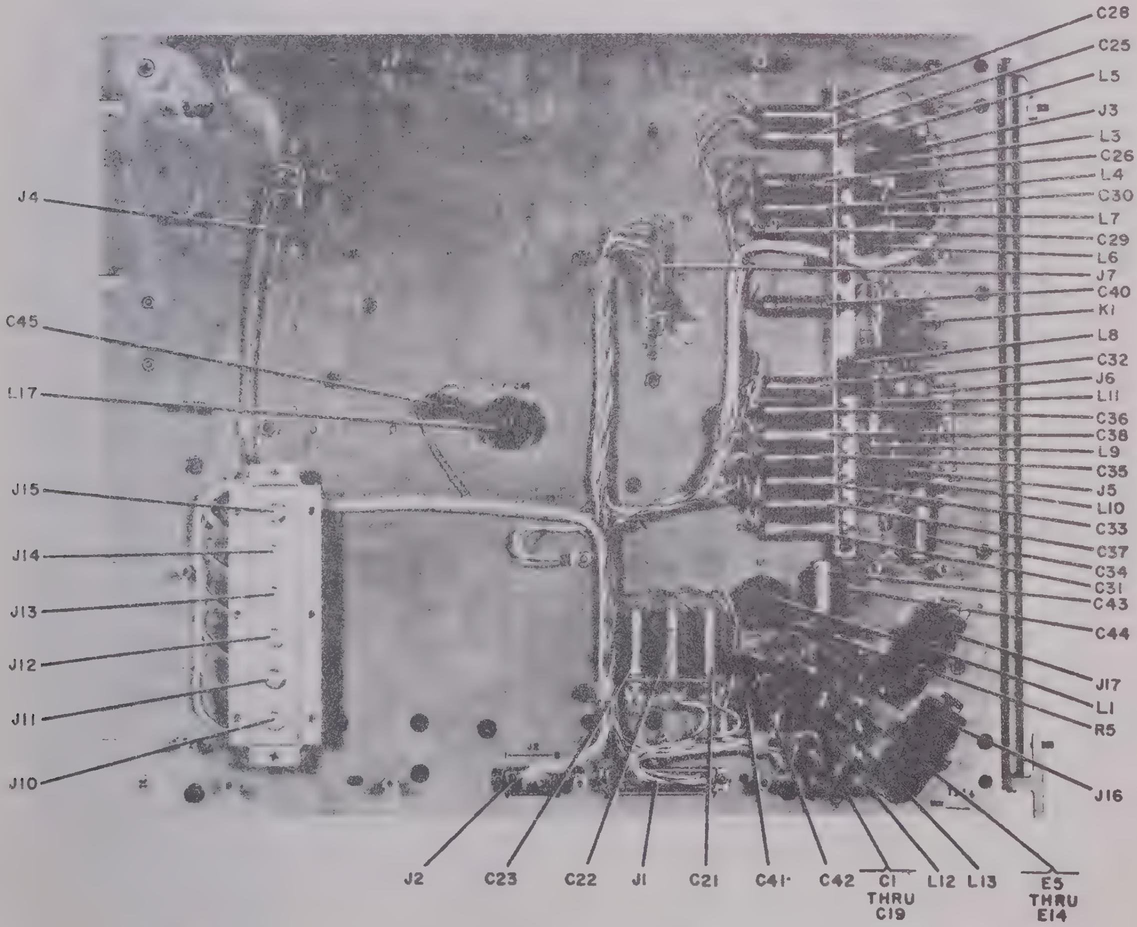

C28
C25
L5
J3
L3
C26
L4
C30
L7
C29
L6
J7
C40
K1
L8
C32
J6
L11
C36
C38
L9
C35
J5
L10
C33
C37
C34
C31
C43
C44
J17
L1
R5
J16
J4
C45
L17
J15
J14
J13
J12
J11
J10
J2
C23
C22
J1
C21
C41
C42
C1 THRU C19
L12
L13
E5 THRU E14

Figure 5-24. Converter-Oscillator CV-731/URC, Rear View with Cover Removed

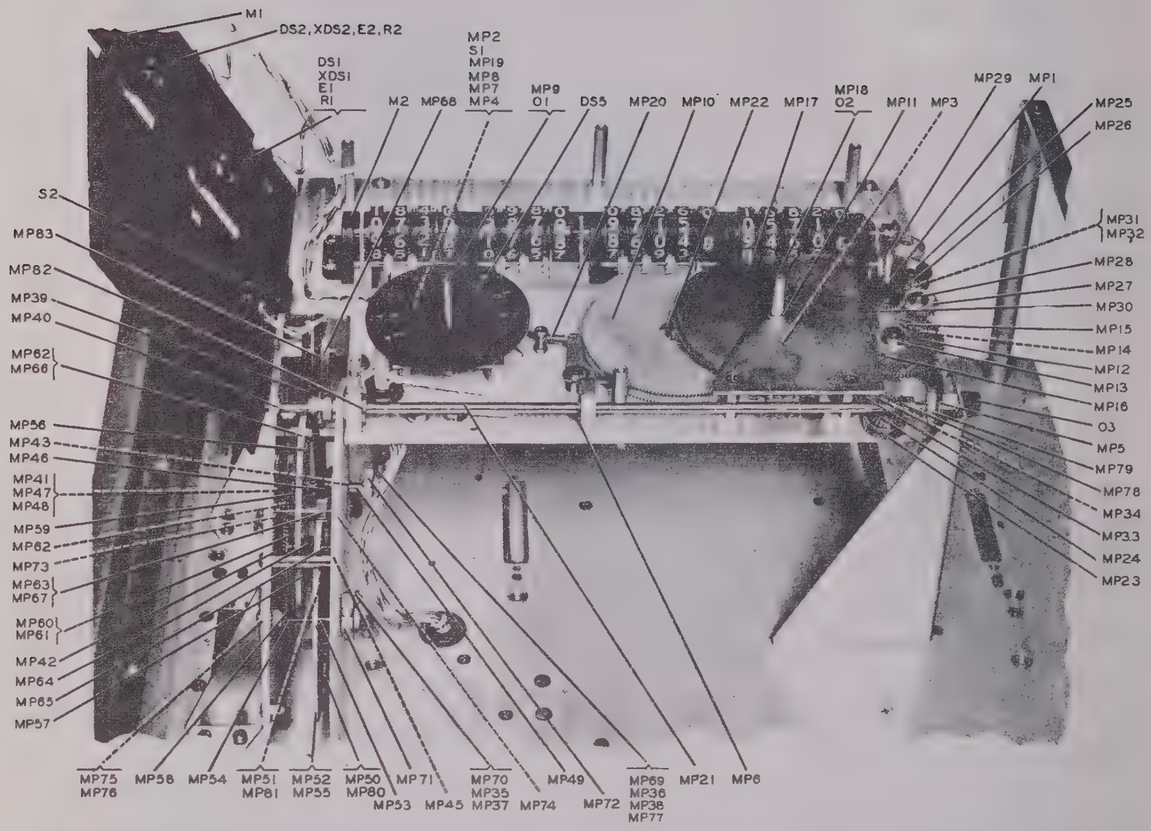

M1
DS2, XDS2, E2, R2
DS1
XDS1
E1
R1
M2
MP68
MP2
S1
MP19
MP8
MP7
MP4
MP9
O1
DS5
MP20
MP10
MP22
MP17
MP18
O2
MP11
MP3
MP29
MP1
MP25
MP26
MP31
MP32
MP28
MP27
MP30
MP15
MP14
MP12
MP13
MP16
O3
MP5
MP79
MP78
MP34
MP33
MP24
MP23
S2
MP83
MP82
MP39
MP40
MP62
MP66
MP56
MP43
MP46
MP41
MP47
MP48
MP59
MP62
MP73
MP63
MP67
MP60
MP61
MP42
MP64
MP65
MP57
MP75
MP76
MP58
MP54
MP51
MP81
MP52
MP55
MP50
MP80
MP53
MP71
MP45
MP70
MP35
MP37
MP74
MP49
MP72
MP69
MP36
MP38
MP77
MP21
MP6

Figure 5-25. Converter-Oscillator CV-731/URC, Front View with Cover Removed

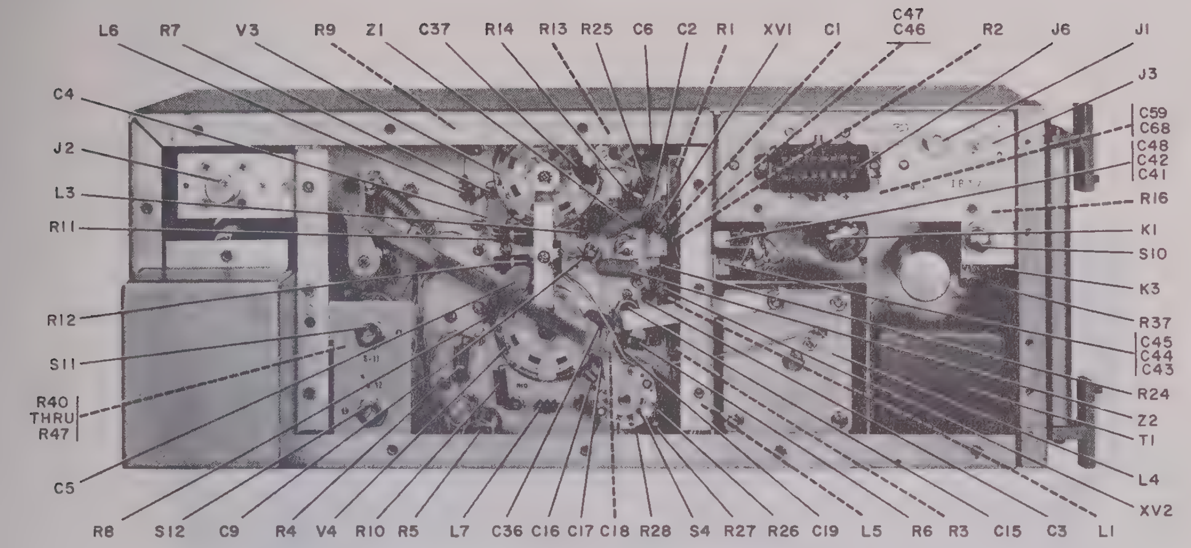

L6
R7
V3
R9
Z1
C37
R14
R13
R25
C6
C2
R1
XV1
C1
C47
C46
R2
J6
J1
J3
C59
C68
C48
C42
C41
R16
K1
S10
K3
R37
C45
C44
C43
R24
Z2
T1
L4
XV2
C4
J2
L3
R11
R12
S11
R40
THRU
R47
C5
R8
S12
C9
R4
V4
R10
R5
L7
C36
C16
C17
C18
R28
S4
R27
R26
C19
L5
R6
R3
C15
C3
L1

Figure 5-23. Radio Frequency Amplifier AM-2061/URT, Rear View, Cover Removed

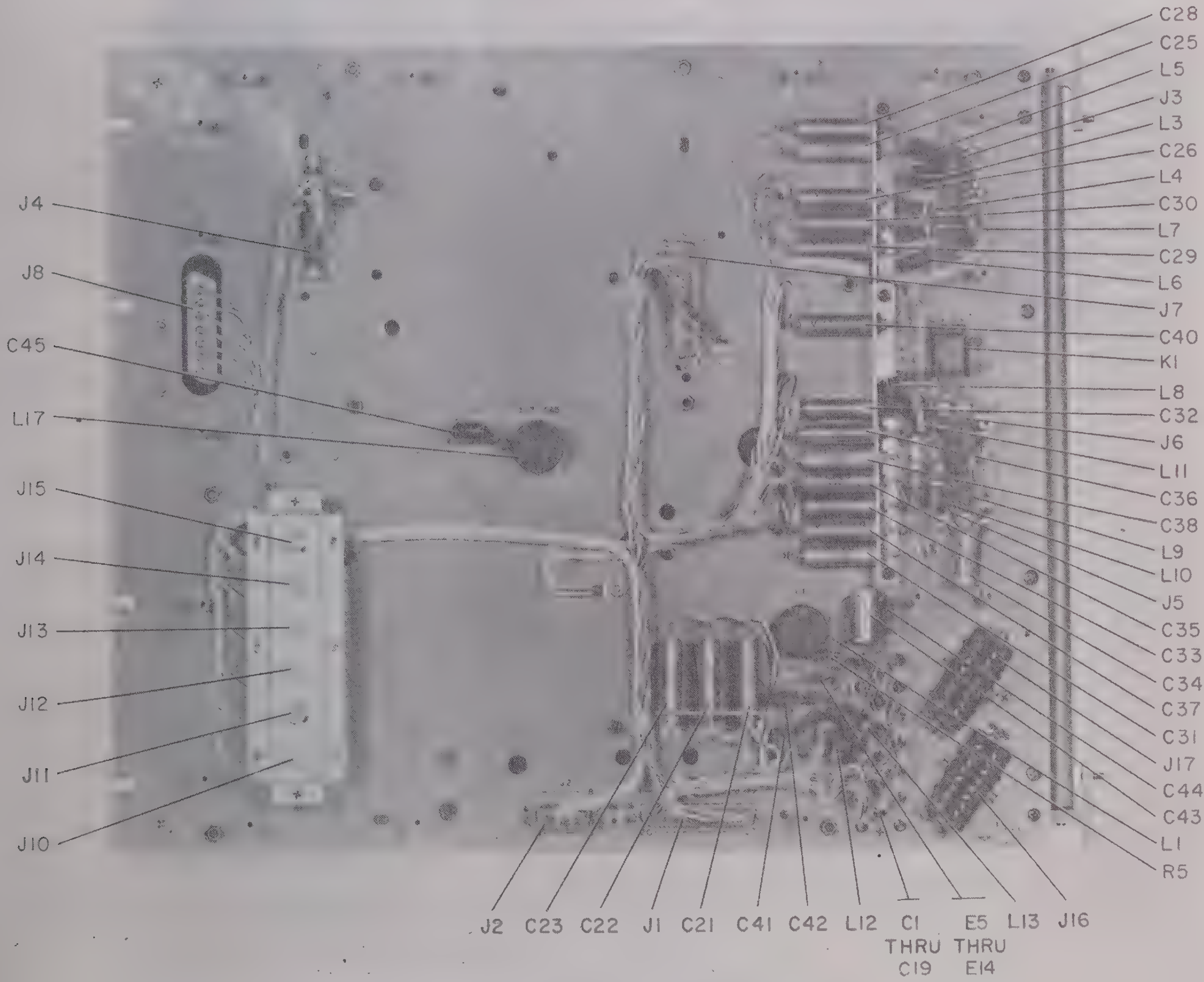

C28
C25
L5
J3
L3
C26
L4
C30
L7
C29
L6
J7
C40
K1
L8
C32
J6
L11
C36
C38
L9
L10
J5
C35
C33
C34
C37
C31
J17
C44
C43
L1
R5
J4
J8
C45
L17
J15
J14
J13
J12
J11
J10
J2
C23
C22
J1
C21
C41
C42
L12
C1
THRU
C19
E5
THRU
E14
L13
J16

Figure 5-24. Converter-Oscillator CV-731/URC, Rear View with Cover Removed

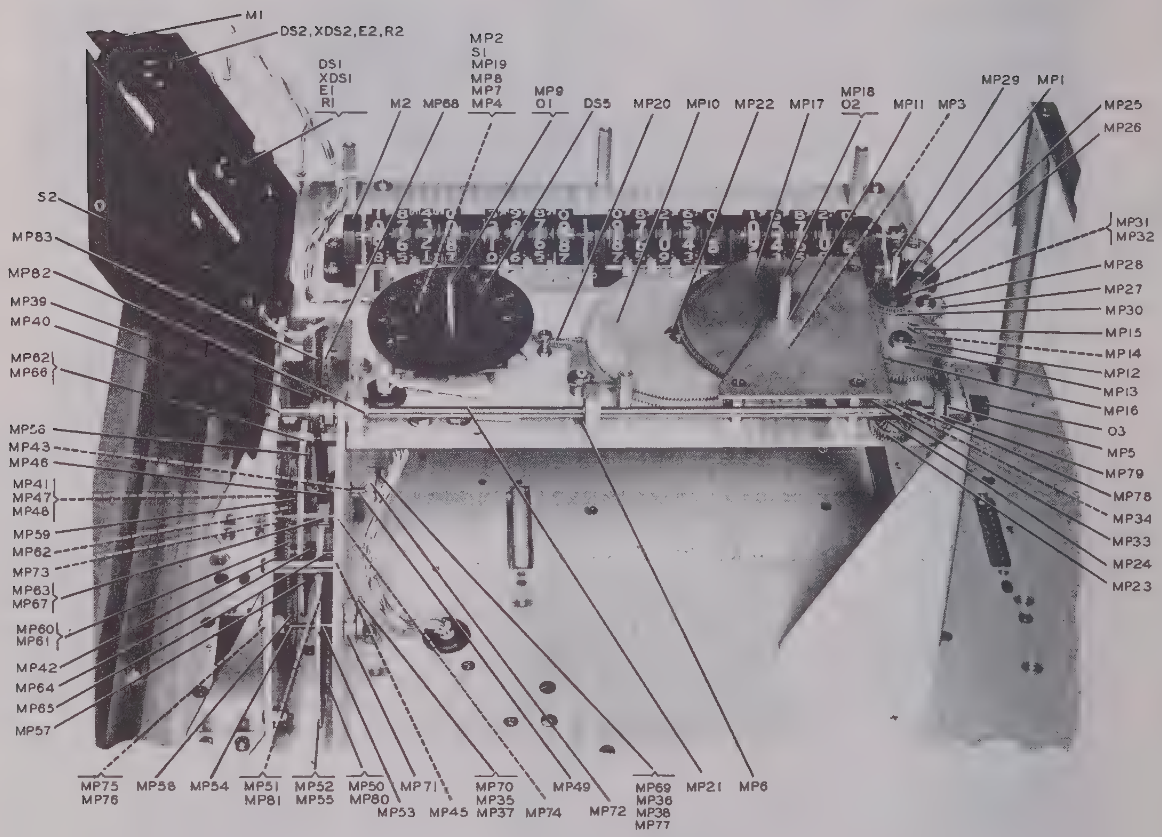

M1
DS2, XDS2, E2, R2
DS1
XDS1
E1
R1
M2
MP68
MP2
S1
MP19
MP8
MP7
MP4
MP9
O1
DS5
MP20
MP10
MP22
MP17
MP18
O2
MP11
MP3
MP29
MP1
MP25
MP26
MP31
MP32
MP28
MP27
MP30
MP15
MP14
MP12
MP13
MP16
O3
MP5
MP79
MP78
MP34
MP33
MP24
MP23
S2
MP83
MP82
MP39
MP40
MP62
MP66
MP56
MP43
MP46
MP41
MP47
MP48
MP59
MP62
MP73
MP63
MP67
MP60
MP61
MP42
MP64
MP65
MP57
MP75
MP76
MP58
MP54
MP51
MP81
MP52
MP55
MP50
MP80
MP53
MP71
MP45
MP70
MP35
MP37
MP74
MP49
MP72
MP69
MP36
MP38
MP77
MP21
MP6

Figure 5-25. Converter-Oscillator CV-731/URC, Front View with Cover Removed

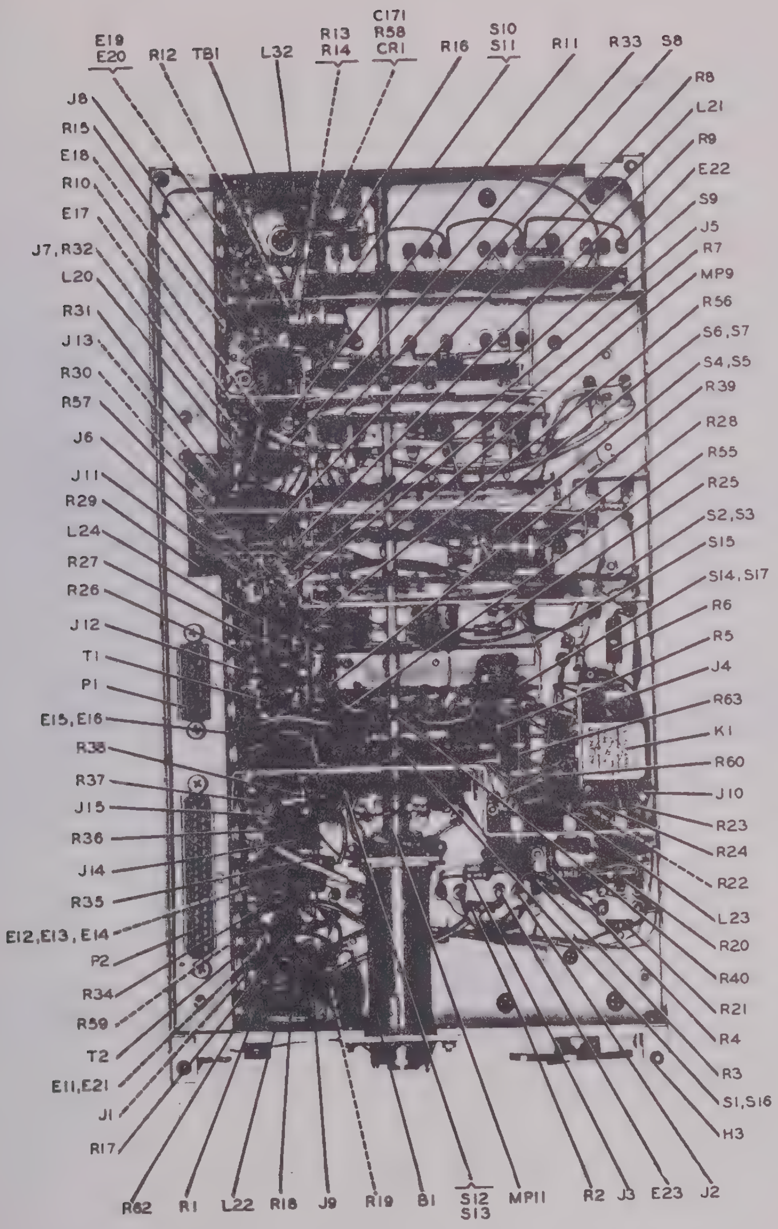

E19
E20
R12
TB1
L32
R13
R14
C171
R58
CR1
R16
S10
S11
R11
R33
S8
R8
L21
R9
E22
S9
J5
R7
MP9
R56
S6,S7
S4,S5
R39
R28
R55
R25
S2,S3
S15
S14,S17
R6
R5
J4
R63
K1
R60
J10
R23
R24
R22
L23
R20
R40
R21
R4
R3
S1,S16
H3
J8
R15
E18
R10
E17
J7,R32
L20
R31
J13
R30
R57
J6
J11
R29
L24
R27
R26
J12
T1
P1
E15,E16
R38
R37
J15
R36
J14
R35
E12,E13,E14
P2
R34
R59
T2
E11,E21
J1
R17
R62
R1
L22
R18
J9
R19
B1
S12
S13
MP11
R2
J3
E23
J2

Figure 5-26. Converter-Oscillator CV-731/URC, R-F Tuner Module, Rear View, Right Side Oblique View

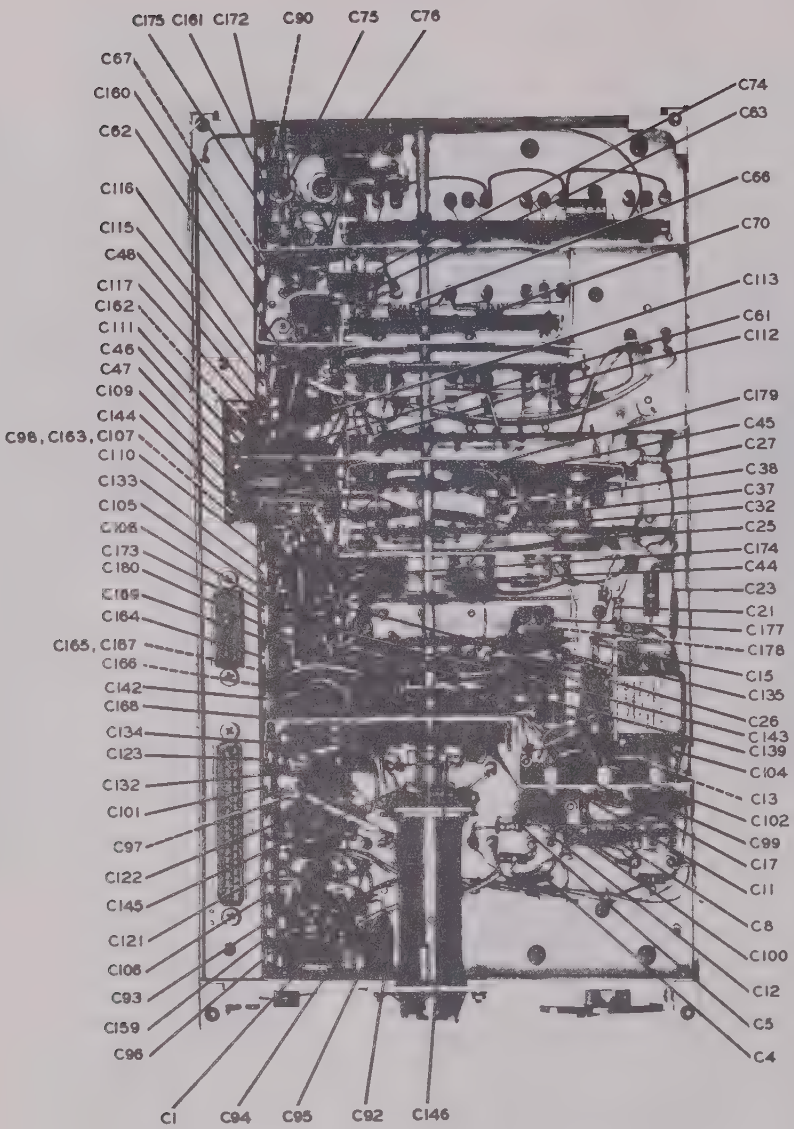

C175
C161
C172
C90
C75
C76
C67
C160
C62
C116
C115
C48
C117
C162
C111
C46
C47
C109
C144
C98, C163, C107
C110
C133
C105
C108
C173
C180
C169
C164
C165, C167
C166
C142
C168
C134
C123
C132
C101
C97
C122
C145
C121
C106
C93
C159
C96
C1
C94
C95
C92
C146
C74
C63
C66
C70
C113
C61
C112
C179
C45
C27
C38
C37
C32
C25
C174
C44
C23
C21
C177
C178
C15
C135
C26
C143
C139
C104
C13
C102
C99
C17
C11
C8
C100
C12
C5
C4

Figure 5-27. Converter-Oscillator CV-731/URC, R-F Tuner Module, Rear View, Left Side Oblique View

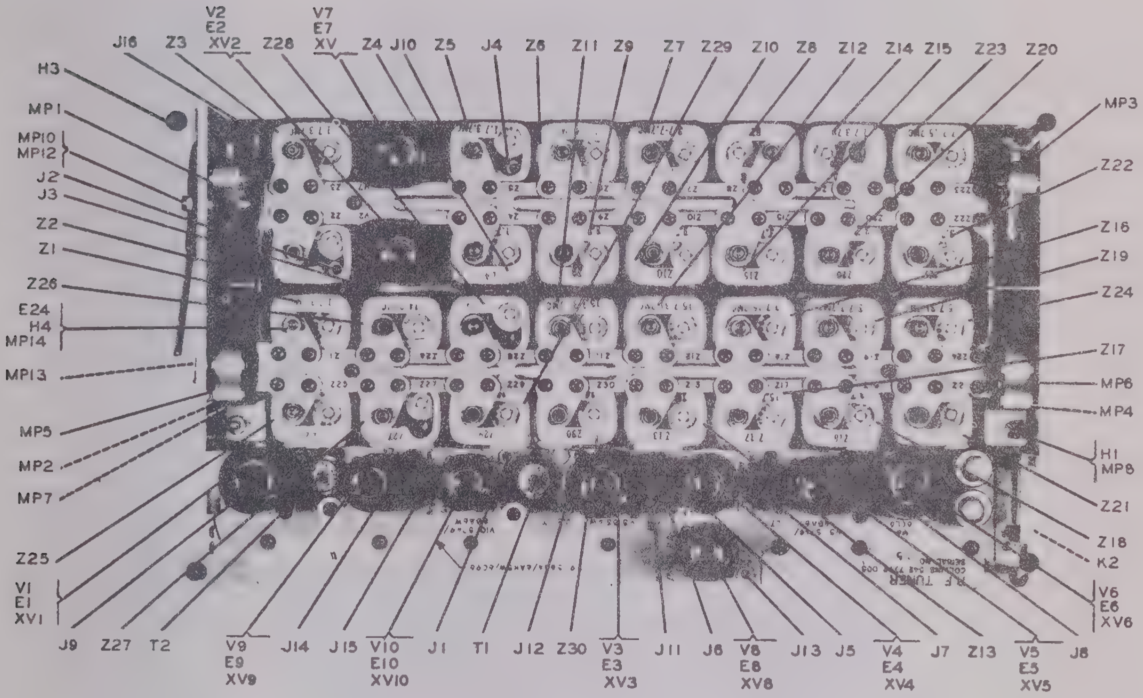
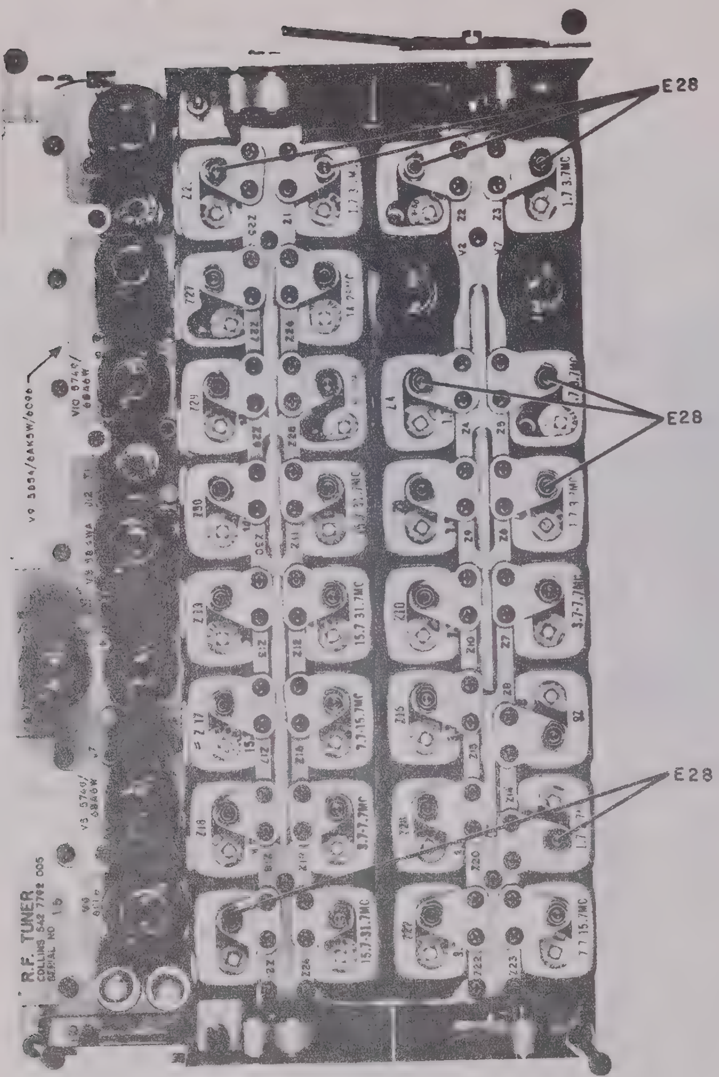

V2
E2
XV2
V7
E7
XV
J16
Z3
Z28
Z4
J10
Z5
J4
Z6
Z11
Z9
Z7
Z29
Z10
Z8
Z12
Z14
Z15
Z23
Z20
H3
MP1
MP10
MP12
J2
J3
Z2
Z1
Z26
E24
H4
MP14
MP13
MP5
MP2
MP7
Z25
V1
E1
XV1
MP3
Z22
Z16
Z19
Z24
Z17
MP6
MP4
H1
MP8
Z21
Z18
K2
V6
E6
XV6
J9
Z27
T2
V9
E9
XV9
J14
J15
V10
E10
XV10
J1
T1
J12
Z30
V3
E3
XV3
J11
J6
V8
E8
XV8
J13
J5
V4
E4
XV4
J7
Z13
V5
E5
XV5
J8

Figure 5-28. Converter-Oscillator CV-731/URC, R-F Tuner Module, Front View


E28
E28
E28
R.F. TUNER
COLLINS 542 7792 005
SERIAL NO

NOTE: 1. ALL CORES NOT KEYED ARE E24.
2. ALL OTHER KEYED COMPONENTS ARE THE SAME AS THAT SHOWN IN FIGURE 5-28.

Figure 5-29. Converter-Oscillator CV-731/URC, R-F Tuner Module, Model B, Front View

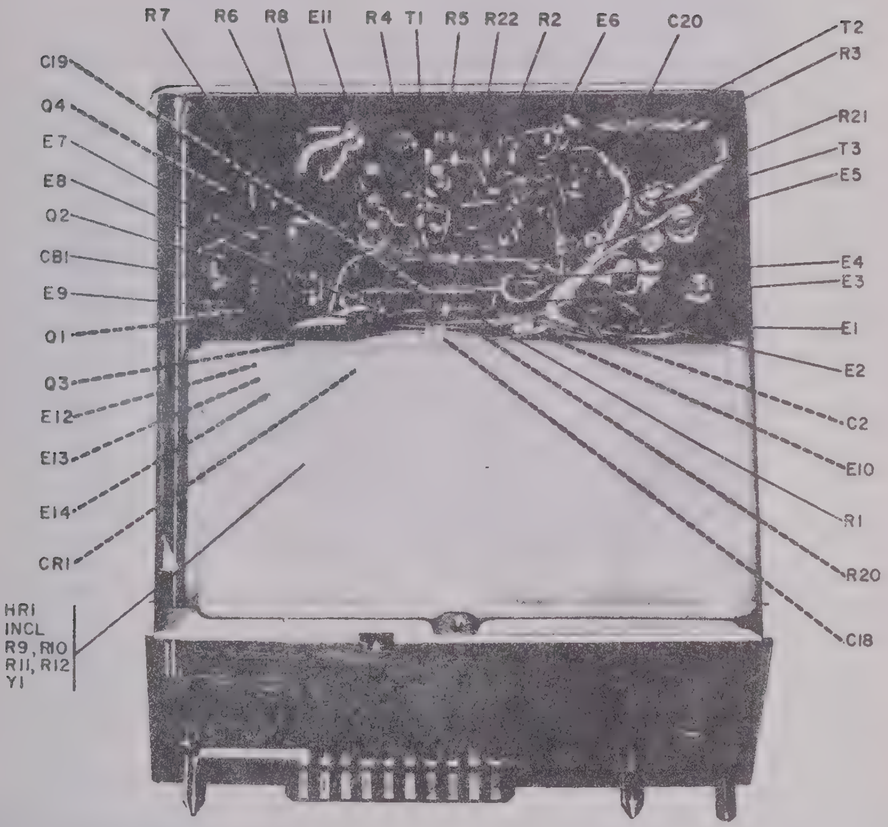

R7
R6
R8
E11
R4
T1
R5
R22
R2
E6
C20
T2
R3
R21
T3
E5
E4
E3
E1
E2
C2
E10
R1
R20
C18
C19
Q4
E7
E8
Q2
CB1
E9
Q1
Q3
E12
E13
E14
CR1
HR1
INCL
R9, R10
R11, R12
Y1

Figure 5-30. Converter-Oscillator CV-731/URC, Reference Oscillator Module, Right Side Oblique View

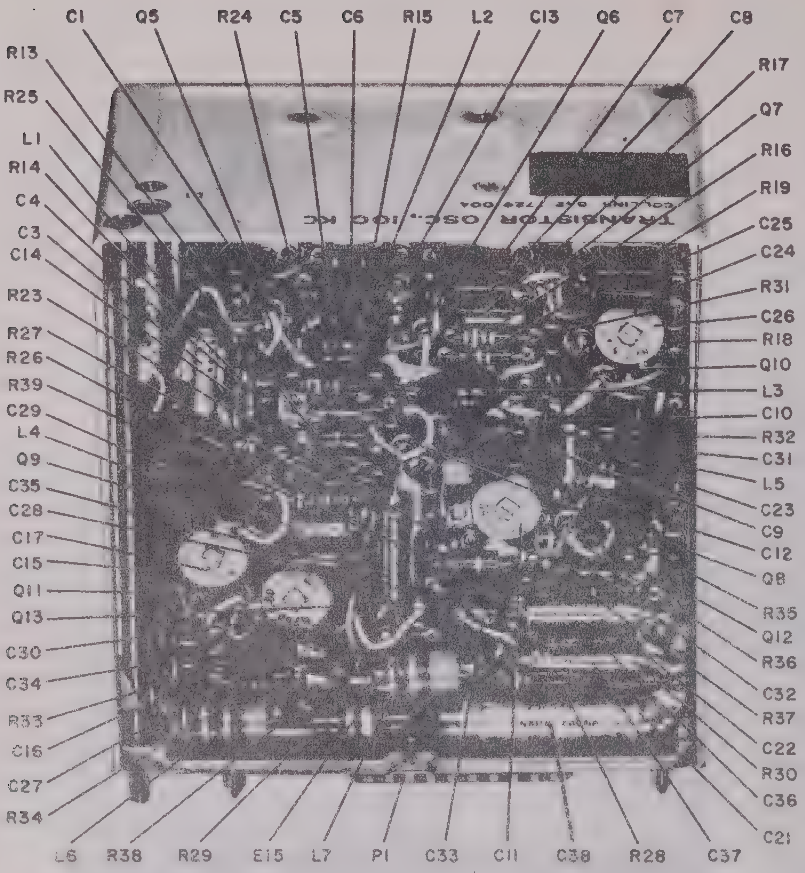

C1
Q5
R24
C5
C6
R15
L2
C13
Q6
C7
C8
R13
R25
L1
R14
C4
C3
C14
R23
R27
R26
R39
C29
L4
Q9
C35
C28
C17
C15
Q11
Q13
C30
C34
R33
C16
C27
R34
R17
Q7
R16
R19
C25
C24
R31
C26
R18
Q10
L3
C10
R32
C31
L5
C23
C9
C12
Q8
R35
Q12
R36
C32
R37
C22
R30
C36
C21
L6
R38
R29
E15
L7
P1
C33
C11
C38
R28
C37
TRANSISTOR OSC., 100 KC

Figure 5-31. Converter-Oscillator CV-731/URC, Reference Oscillator Module, Left Side Oblique View

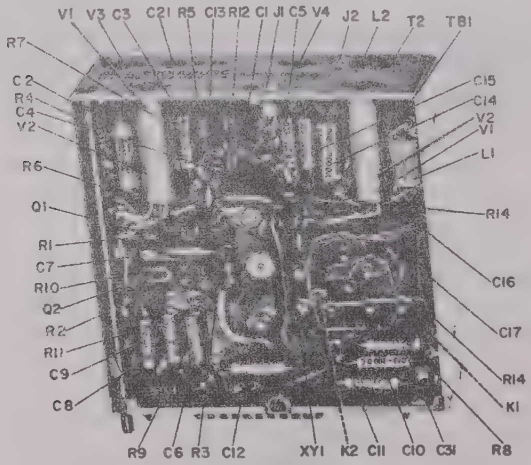

V1
V3
C3
C21
R5
C13
R12
C1
J1
C5
V4
J2
L2
T2
TB1
R7
C2
R4
C4
V2
R6
Q1
R1
C7
R10
Q2
R2
R11
C9
C8
C15
C14
V2
V1
L1
R14
C16
C17
R14
K1
R8
R9
C6
R3
C12
XY1
K2
C11
C10
C31

Figure 5-32. Converter-Oscillator CV-731/URC, Sidestep Oscillator Module, Right Side Oblique View

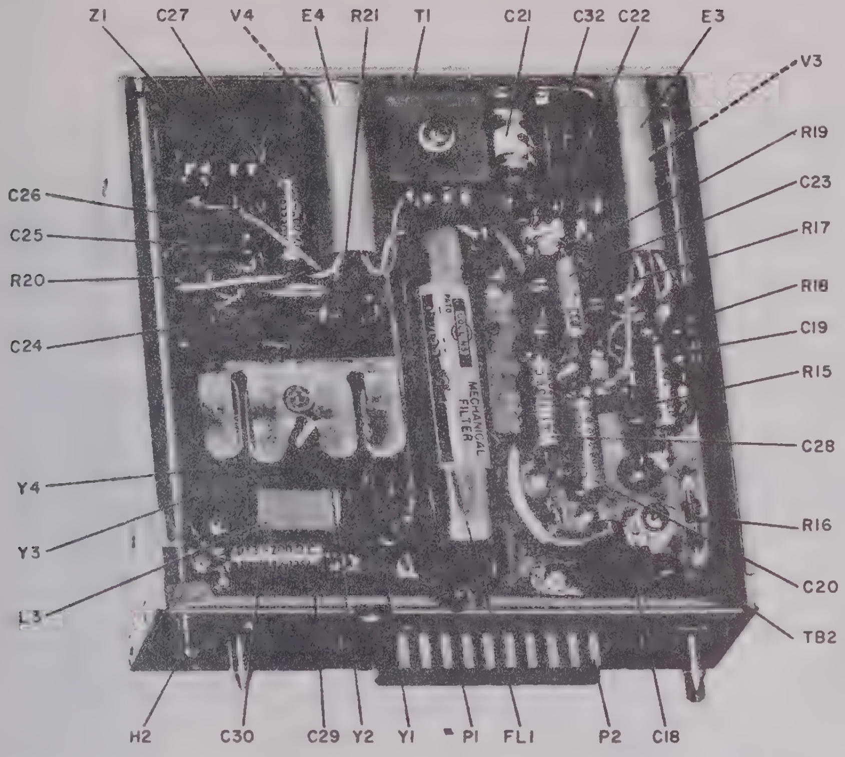

Z1
C27
V4
E4
R21
T1
C21
C32
C22
E3
V3
R19
C23
R17
R18
C19
R15
C28
R16
C20
TB2
C26
C25
R20
C24
Y4
Y3
L3
MECHANICAL FILTER
H2
C30
C29
Y2
Y1
P1
FL1
P2
C18

Figure 5-33. Converter-Oscillator CV-731/URC, Sidestep Oscillator Module, Left Side Oblique View

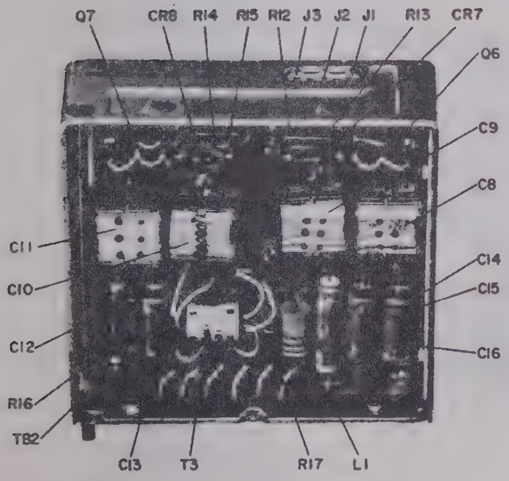

Q7
CR8
R14
R15
R12
J3
J2
J1
R13
CR7
Q6
C9
C8
C11
C10
C14
C15
C12
C16
R16
TB2
C13
T3
R17
L1

Figure 5-34. Converter-Oscillator CV-731/URC, Frequency Divider Module, Right Side Oblique View

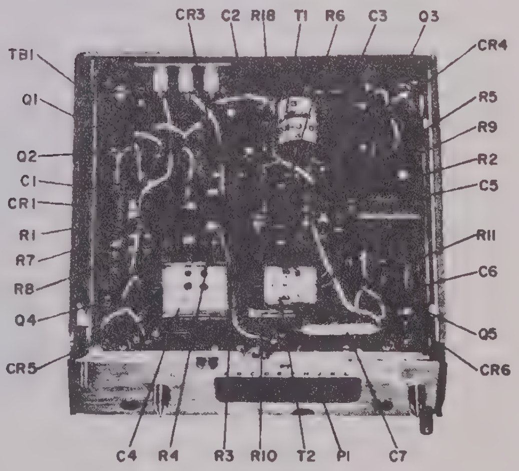

CR3
C2
R18
T1
R6
C3
Q3
TB1
CR4
Q1
R5
R9
Q2
R2
C1
C5
CR1
R1
R11
R7
C6
R8
Q4
Q5
CR5
CR6
C4
R4
R3
R10
T2
P1
C7

Figure 5-35. Converter-Oscillator CV-731/URC, Frequency Divider Module, Left Side Oblique View

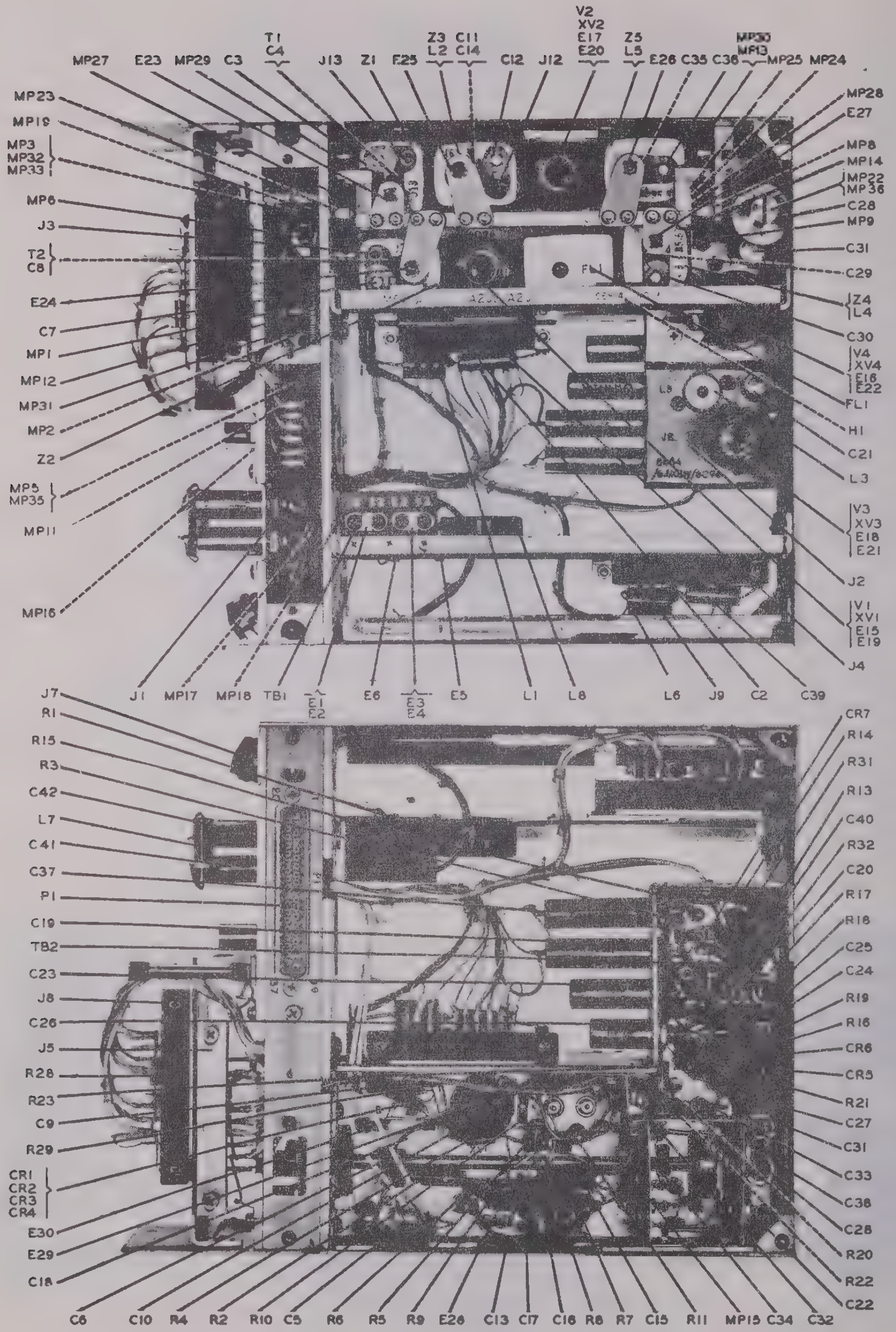

MP27
E23
MP29
C3
T1
C4
J13
Z1
E25
Z3
L2
C11
C14
C12
J12
V2
XV2
E17
E20
Z5
L5
E26
C35
C36
MP30
MP13
MP25
MP24
MP23
MP19
MP3
MP32
MP33
MP6
J3
T2
C8
E24
C7
MP1
MP12
MP31
MP2
Z2
MP5
MP35
MP11
MP16
MP28
E27
MP8
MP14
MP22
MP36
C28
MP9
C31
C29
Z4
L4
C30
V4
XV4
E16
E22
FL1
H1
C21
L3
V3
XV3
E18
E21
J2
V1
XV1
E15
E19
J4
J1
MP17
MP18
TB1
E1
E2
E6
E3
E4
E5
L1
L8
L6
J9
C2
C39
J7
R1
R15
R3
C42
L7
C41
C37
P1
C19
TB2
C23
J8
C26
J5
R28
R23
C9
R29
CR1
CR2
CR3
CR4
E30
E29
C18
CR7
R14
R31
R13
C40
R32
C20
R17
R18
C25
C24
R19
R16
CR6
CR5
R21
C27
C31
C33
C36
C28
R20
R22
C22
C6
C10
R4
R2
R10
C5
R6
R5
R9
E26
C13
C17
C16
R8
R7
C15
R11
MP15
C34
C32

Figure 5-36. Converter-Oscillator CV-731/URC, SMO Module Model A, Master Oscillator Assembly

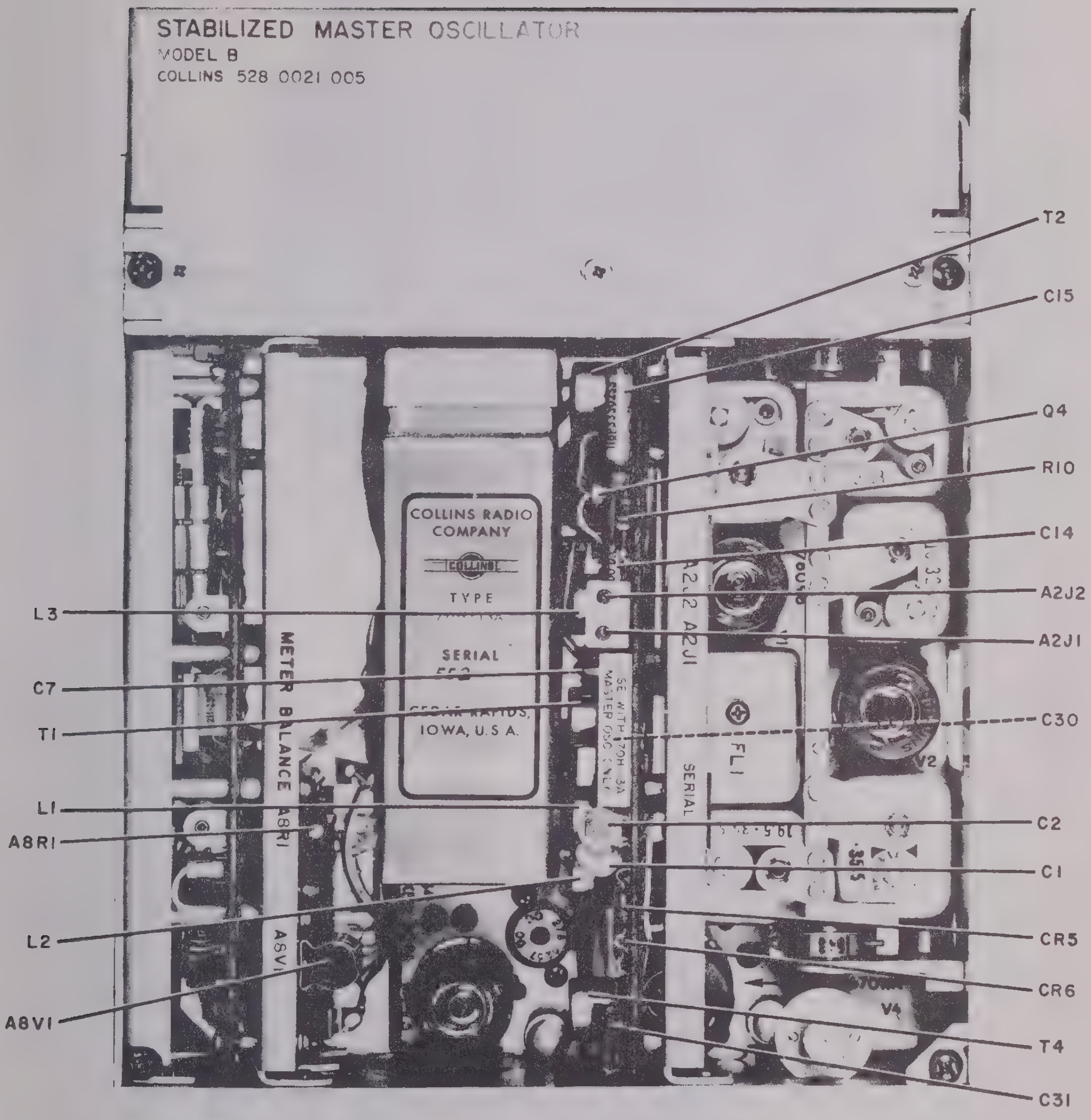

STABILIZED MASTER OSCILLATOR
MODEL B
COLLINS 528 0021 005
COLLINS RADIO COMPANY
COLLINS
TYPE
SERIAL
CEDAR RAPIDS, IOWA, U.S.A.
METER BALANCE A8R1
A8V1
A2J2 A2J1
FL1
SERIAL
V2
V4
T2
C15
Q4
R10
C14
A2J2
A2J1
C30
C2
C1
CR5
CR6
T4
C31
L3
C7
T1
L1
A8R1
L2
A8V1

Figure 5-37. Converter-Oscillator CV-731/URC,
SMO Module, Model B

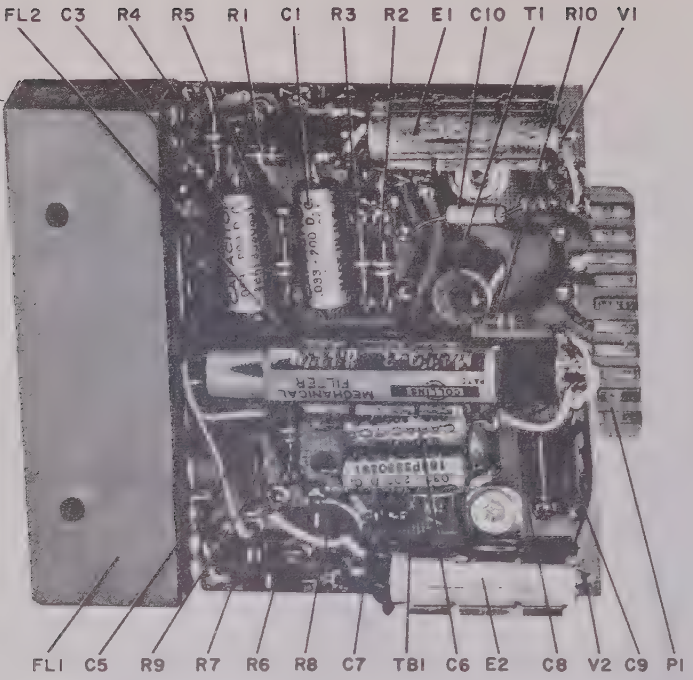

FL2
C3
R4
R5
R1
C1
R3
R2
E1
C10
T1
R10
V1
FL1
C5
R9
R7
R6
R8
C7
TB1
C6
E2
C8
V2
C9
P1

Figure 5-38. Converter-Oscillator CV-731/URC, SMO Module, I-F Mixer Assembly

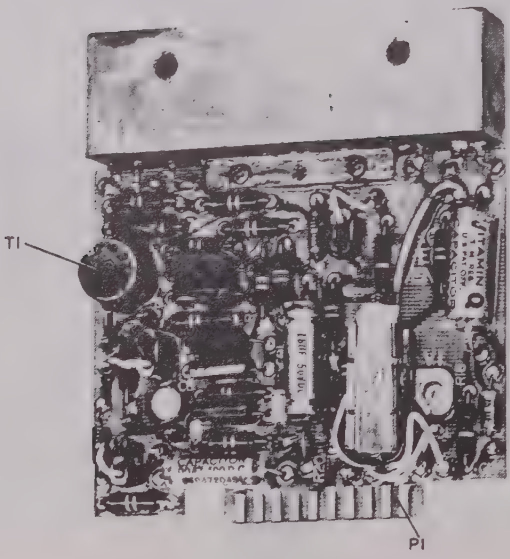


Figure 5-39. Converter-Oscillator CV-731/URC, SMO Module, 4-Kc Spectrum Generator Assembly

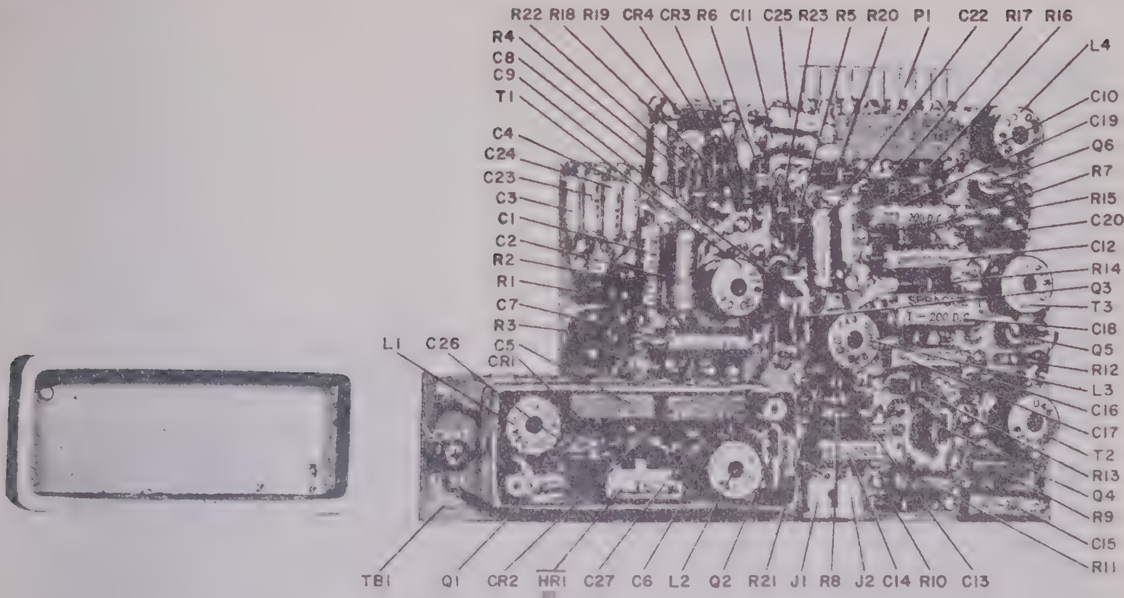

R22
R18
R19
CR4
CR3
R6
C11
C25
R23
R5
R20
P1
C22
R17
R16
L4
R4
C8
C9
T1
C4
C24
C23
C3
C1
C2
R2
R1
C7
R3
L1
C26
C5
CR1
C10
C19
Q6
R7
R15
C20
C12
R14
Q3
T3
C18
Q5
R12
L3
C16
C17
T2
R13
Q4
R9
C15
R11
TB1
Q1
CR2
HR1
C27
C6
L2
Q2
R21
J1
R8
J2
C14
R10
C13

Figure 5-40. Converter-Oscillator CV-731/URC, SMO Module Model A, Signal I-F Amplifier

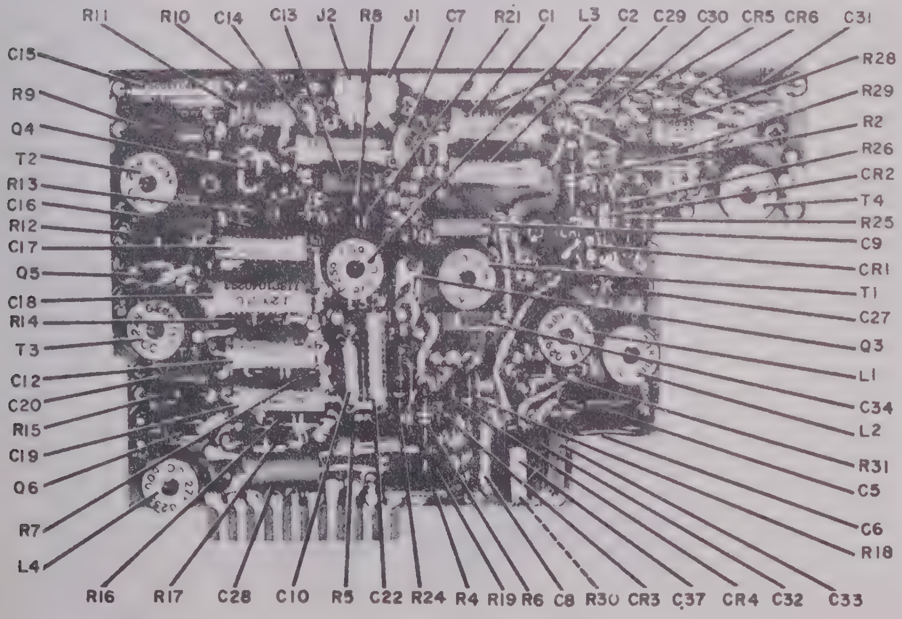

R11
R10
C14
C13
J2
R8
J1
C7
R21
C1
L3
C2
C29
C30
CR5
CR6
C31
C15
R9
Q4
T2
R13
C16
R12
C17
Q5
C18
R14
T3
C12
C20
R15
C19
Q6
R7
L4
R28
R29
R2
R26
CR2
T4
R25
C9
CR1
T1
C27
Q3
L1
C34
L2
R31
C5
C6
R18
R16
R17
C28
C10
R5
C22
R24
R4
R19
R6
C8
R30
CR3
C37
CR4
C32
C33

Figure 5-41. Converter-Oscillator CV-731/URC, SMO Module Model B, I-F Amplifier Assembly

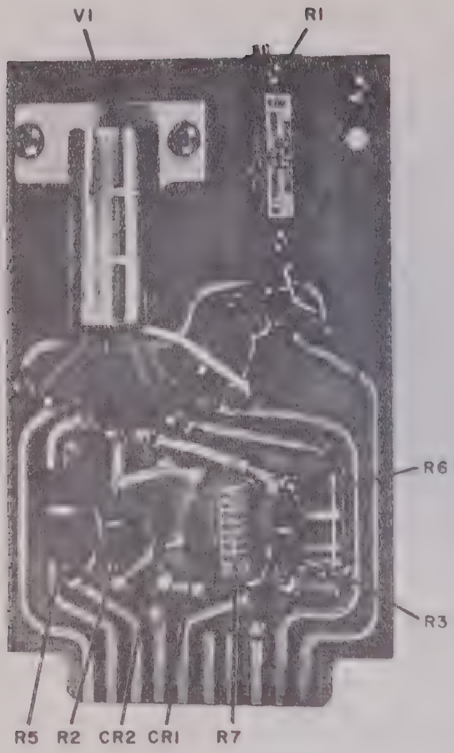

V1
R1
R6
R3
R5
R2
CR2
CR1
R7

Figure 5-42. Converter-Oscillator CV-731/URC, SMO Module, Model B and C, Meter Amplifier Assembly

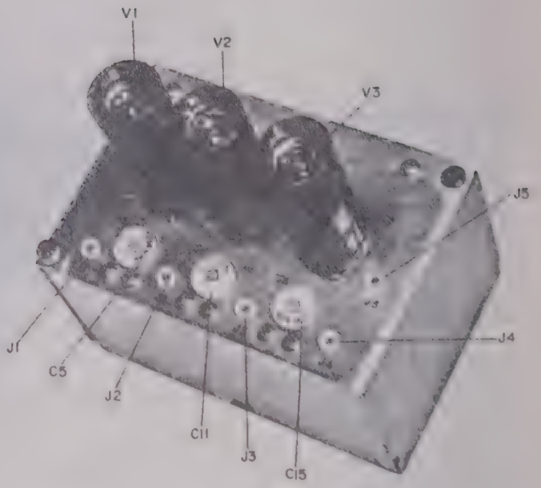

V1
V2
V3
J5
J4
J1
C5
J2
C11
J3
C15

Figure 5-43. Converter-Oscillator CV-731/URC, Isolation Amplifier Module, Alignment Points

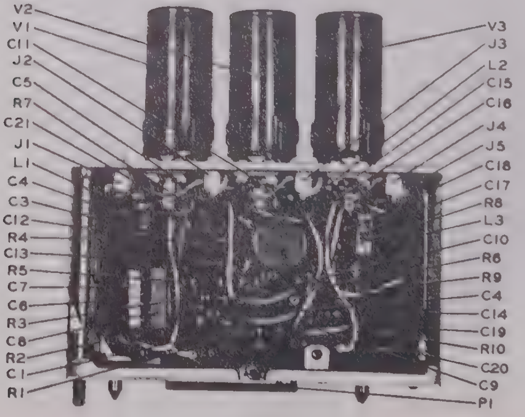

V2
V1
C11
J2
C5
R7
C21
J1
L1
C4
C3
C12
R4
C13
R5
C7
C6
R3
C8
R2
C1
R1
V3
J3
L2
C15
C16
J4
J5
C18
C17
R8
L3
C10
R6
R9
C4
C14
C19
R10
C20
C9
P1

Figure 5-44. Converter-Oscillator CV-731/URC, Isolation Amplifier Module

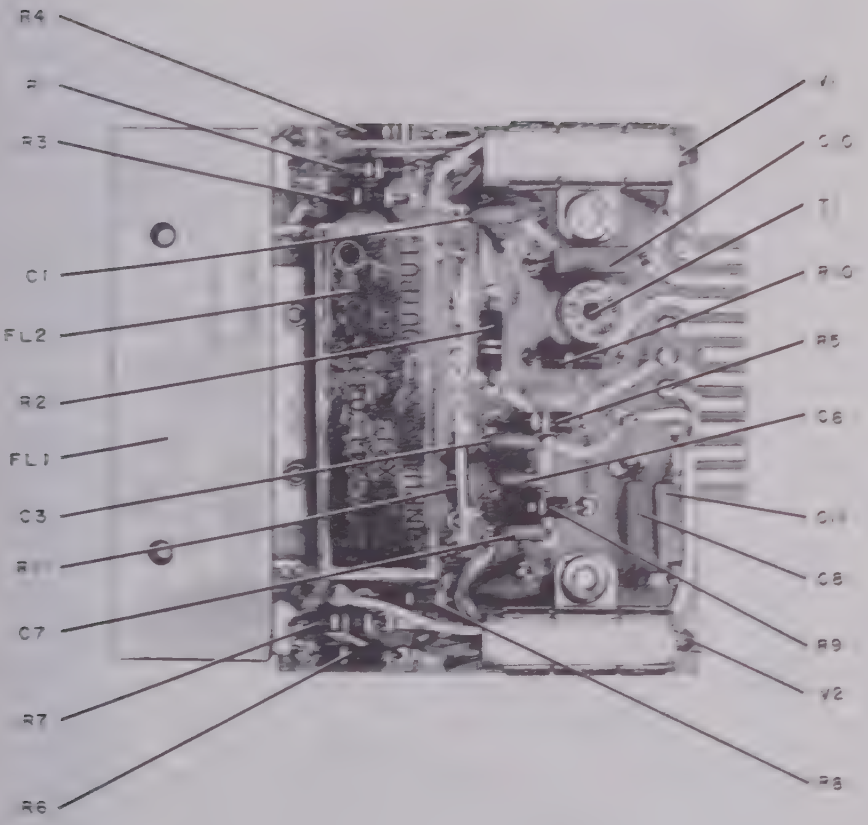

R4
R1
R3
C1
FL2
R2
FL1
C3
R11
C7
R7
R6
V1
C10
T1
R10
R5
C6
C11
C8
R9
V2
R8

Figure 5-45. Converter-Oscillator CV-731/URC, SMO Module, Model C, I-F Mixer Assembly

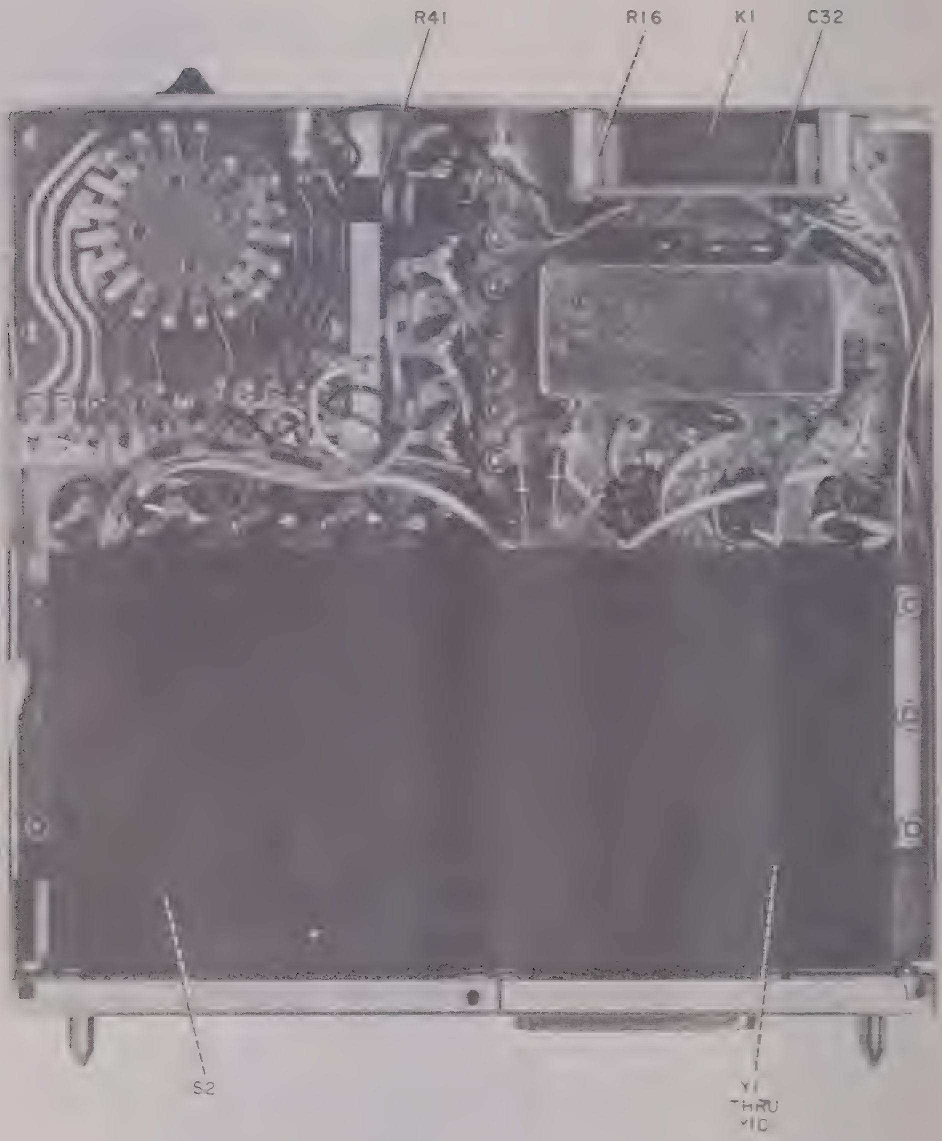
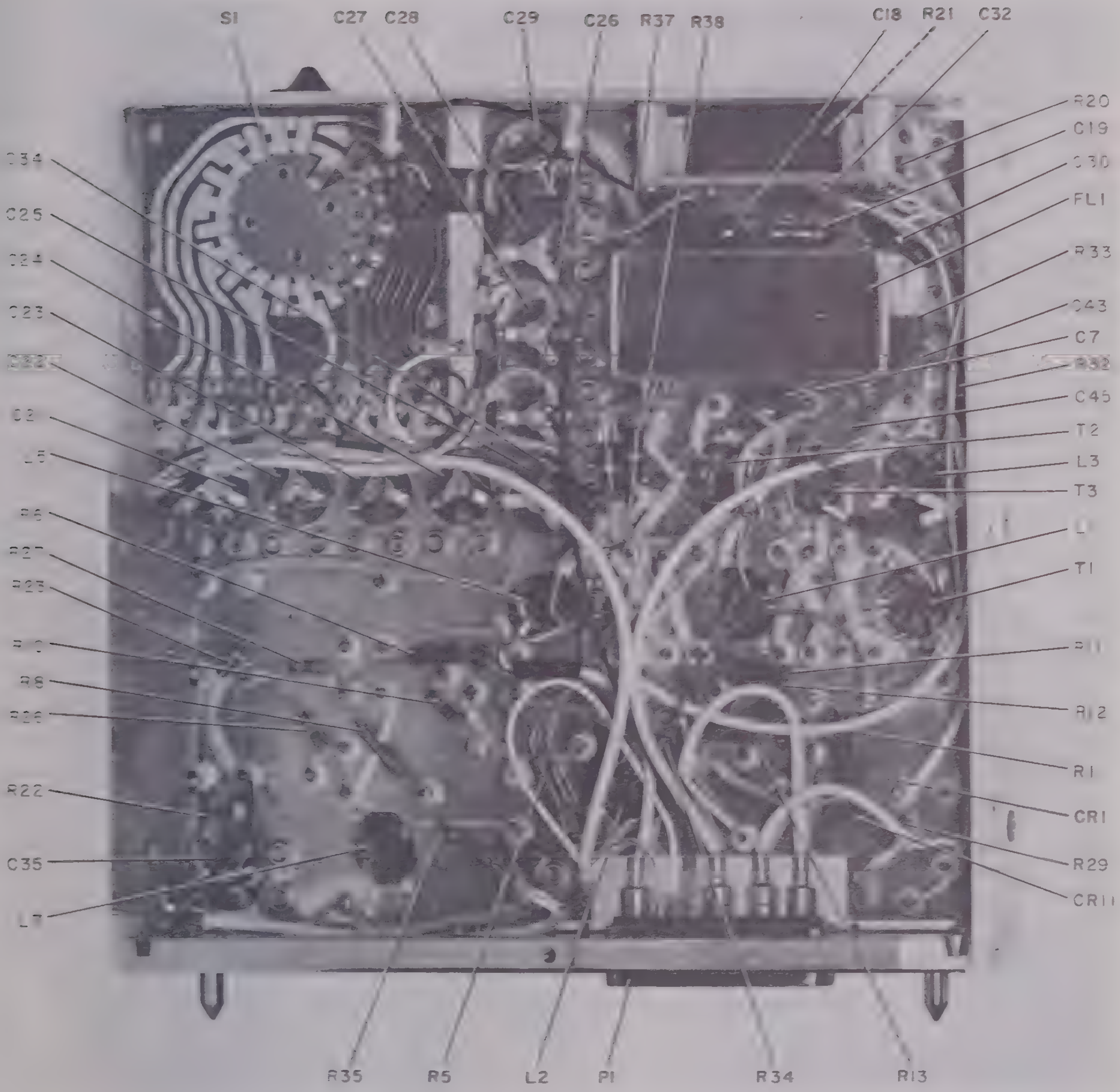

R41
R16
K1
C32
S2
Y1
THRU
Y10

Figure 5-46. Converter-Oscillator CV-731/URC, 0.1-Kc Tuning Module CV-1749( )/UR, Side View, Left Cover Removed (Used on AN/URC-32B Equipment Only)


S1
C27
C28
C29
C26
R37
R38
C18
R21
C32
C34
C25
C24
C23
C22
C2
L5
R6
R27
R23
R10
R8
R26
R22
C35
L7
R20
C19
C30
FL1
R33
C43
C7
R32
C45
T2
L3
T3
L1
T1
R11
R12
R1
CR1
R29
CR11
R35
R5
L2
P1
R34
R13

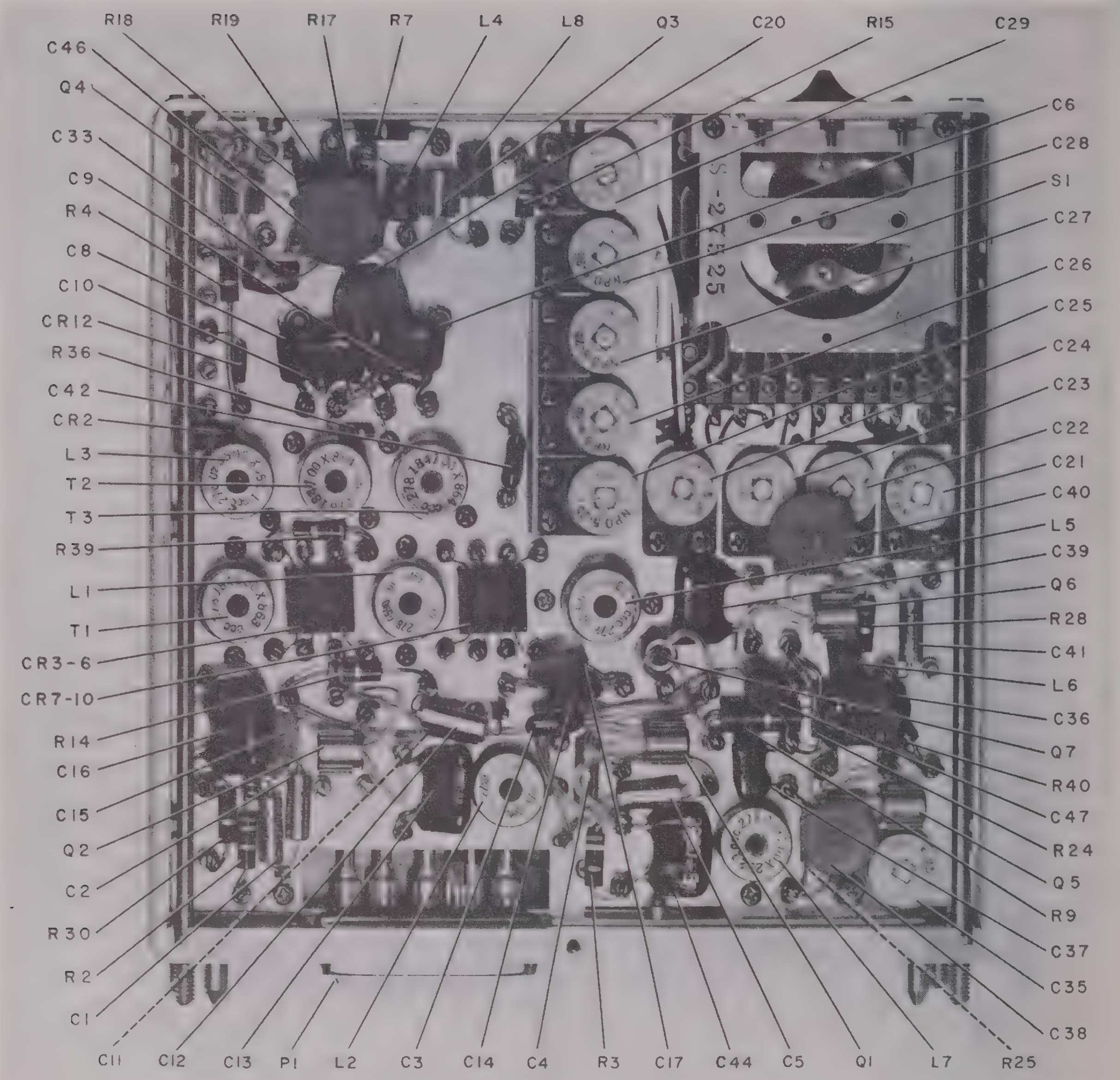

R18
R19
R17
R7
L4
L8
Q3
C20
R15
C29
C46
Q4
C33
C9
R4
C8
C10
CR12
R36
C42
CR2
L3
T2
T3
R39
L1
T1
CR3-6
CR7-10
R14
C16
C15
Q2
C2
R30
R2
C1
C6
C28
S1
C27
C26
C25
C24
C23
C22
C21
C40
L5
C39
Q6
R28
C41
L6
C36
Q7
R40
C47
R24
Q5
R9
C37
C35
C38
C11
C12
C13
P1
L2
C3
C14
C4
R3
C17
C44
C5
Q1
L7
R25

Figure 5-48. Converter-Oscillator CV-731/URC, 0.1-Kc Tuning Module CV-1749( )/UR, Side View, Right Cover Removed (Used on AN/URC-32B Equipment Only)

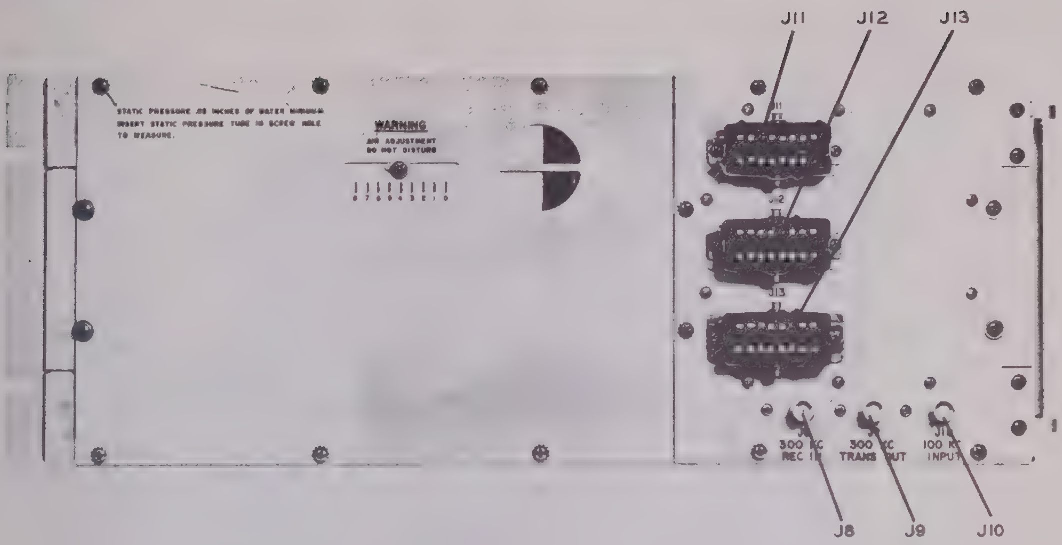

J11
J12
J13
STATIC PRESSURE .05 INCHES OF WATER MINIMUM
INSERT STATIC PRESSURE TUBE IN SCREW HOLE
TO MEASURE.
WARNING
AIR ADJUSTMENT
DO NOT DISTURB
8 7 6 5 4 3 2 1 0
J11
J12
J13
300 KC
REC IN
300 KC
TRANS OUT
100 KC
INPUT
J8
J9
J10

Figure 5-49. Amplifier-Converter-Modulator AM-2064/URC, Chassis, Rear View

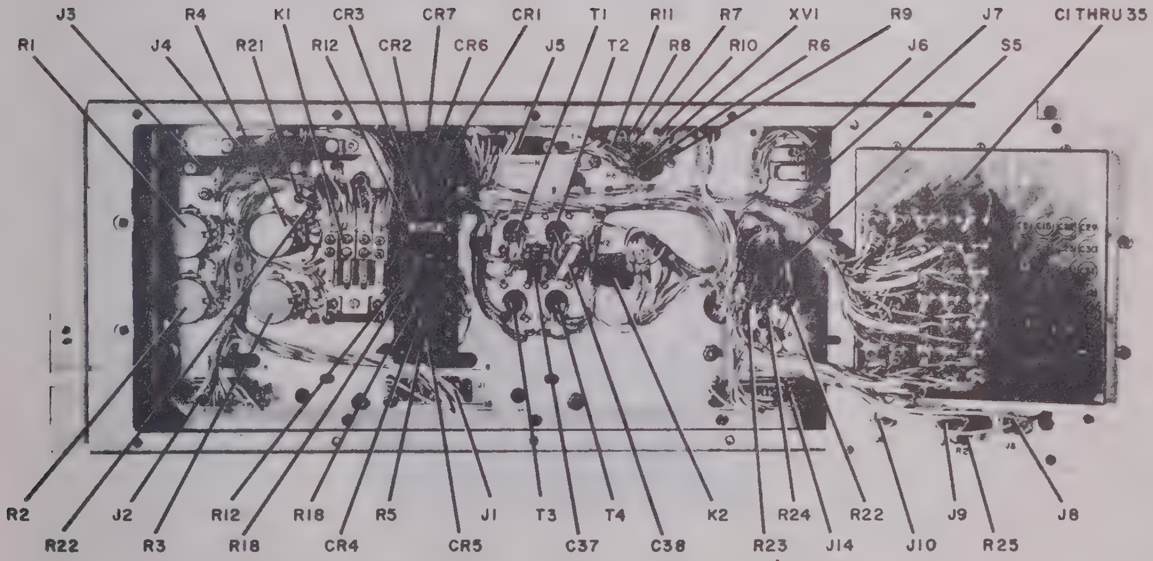

J3
R4
K1
CR3
CR7
CR1
T1
R11
R7
XV1
R9
J7
C1 THRU 35
R1
J4
R21
R12
CR2
CR6
J5
T2
R8
R10
R6
J6
S5
R2
J2
R12
R18
R5
J1
T3
T4
K2
R24
R22
J9
J8
R22
R3
R18
CR4
CR5
C37
C38
R23
J14
J10
R25

Figure 5-50. Amplifier-Converter-Modulator AM-2064/URC, Chassis, Rear View, Cover Removed

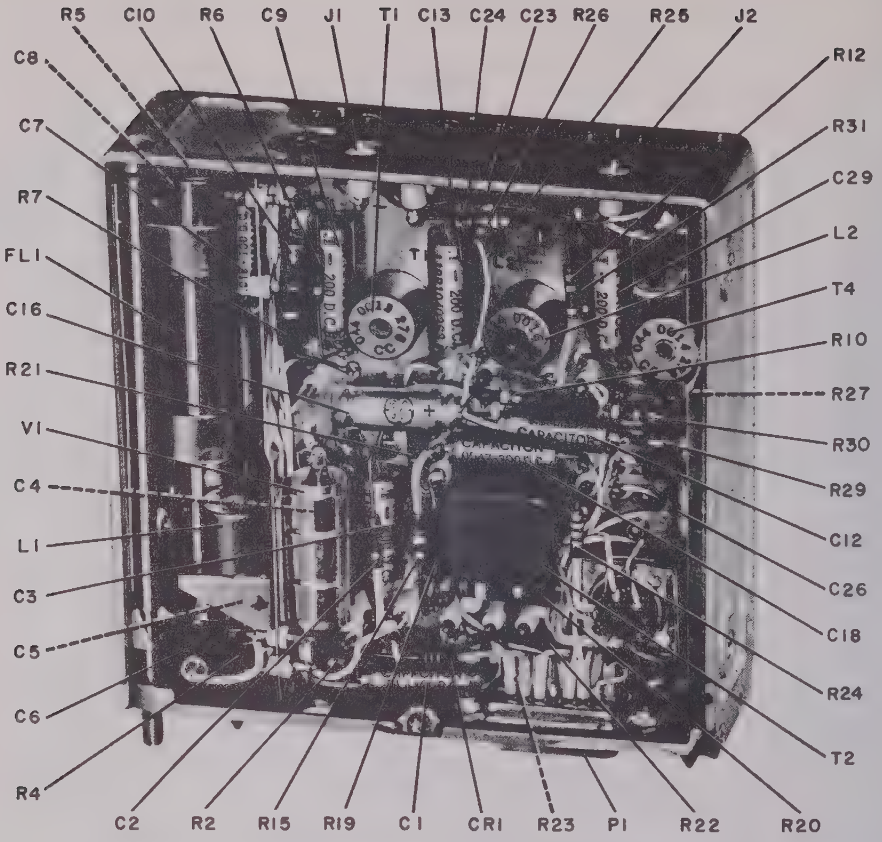

R5
C10
R6
C9
J1
T1
C13
C24
C23
R26
R25
J2
R12
C8
C7
R7
FL1
C16
R21
V1
C4
L1
C3
C5
C6
R4
R31
C29
L2
T4
R10
R27
R30
R29
C12
C26
C18
R24
T2
R20
C2
R2
R15
R19
C1
CR1
R23
P1
R22

Figure 5-51. Amplifier-Converter-Modulator AM-2064/URC, LSB I-F/A-F Amplifier Module and USB I-F/A-F Amplifier Module, Front View with Cover Removed

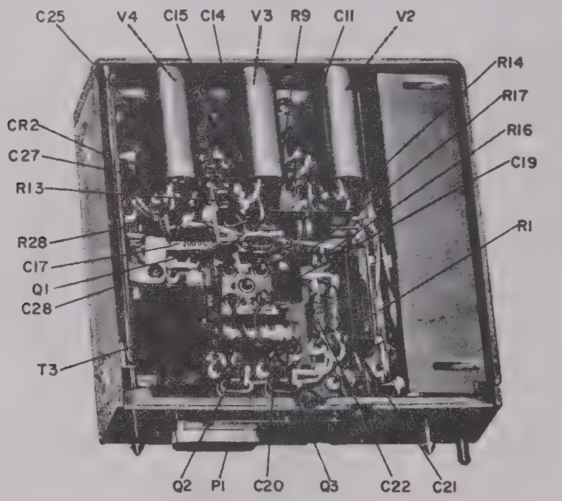

C25
V4
C15
C14
V3
R9
C11
V2
R14
R17
R16
C19
R1
CR2
C27
R13
R28
C17
Q1
C28
T3
Q2
P1
C20
Q3
C22
C21

Figure 5-52. Amplifier-Converter-Modulator AM-2064/URC, LSB I-F/A-F Amplifier Module and USB I-F/A-F Amplifier Module, Rear View with Cover Removed

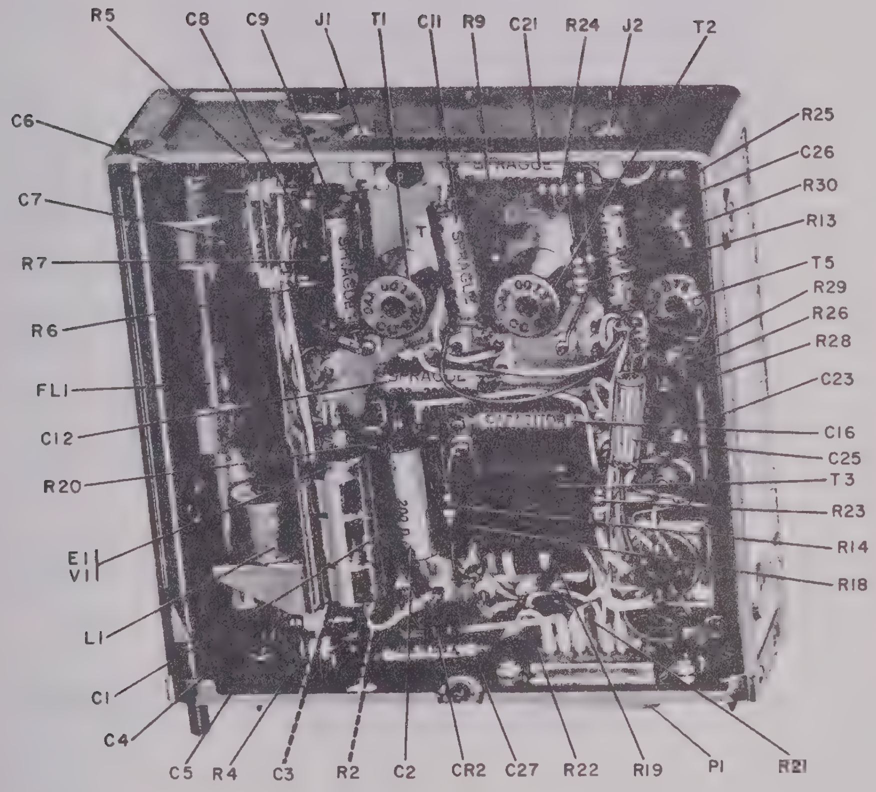

R5
C8
C9
J1
T1
C11
R9
C21
R24
J2
T2
C6
C7
R7
R6
FL1
C12
R20
E1
V1
L1
C1
C4
C5
R4
C3
R2
C2
CR2
C27
R22
R19
P1
R21
R25
C26
R30
R13
T5
R29
R26
R28
C23
C16
C25
T3
R23
R14
R18

Figure 5-53. Amplifier-Converter-Modulator AM-2064/URC, AM I-F/A-F Amplifier Module, Front View, Cover Removed

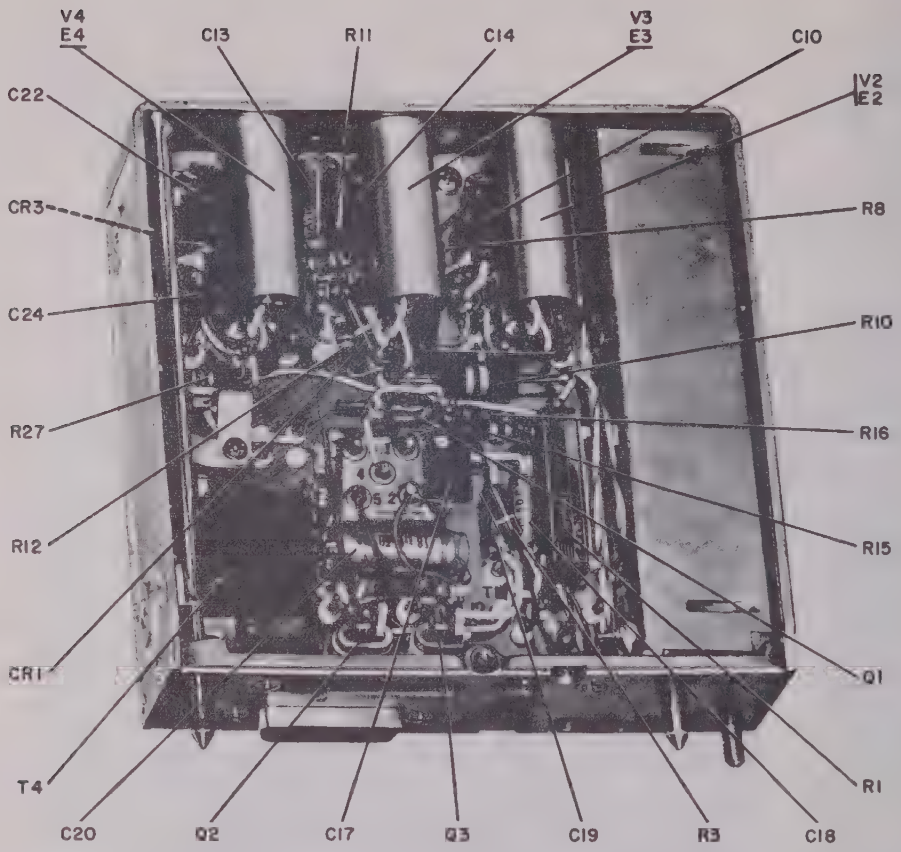

V4
E4
C13
R11
C14
V3
E3
C10
V2
E2
C22
CR3
R8
C24
R10
R27
R16
R12
R15
CR1
Q1
T4
R1
C20
Q2
C17
Q3
C19
R3
C18

Figure 5-54. Amplifier-Converter-Modulator AM-2064/URC, AM I-F/A-F Amplifier Module, Rear View, Cover Removed

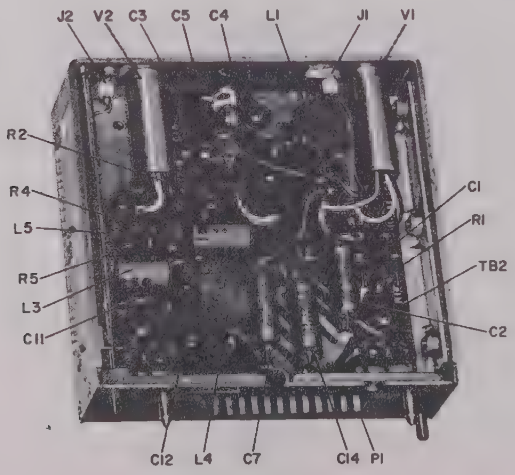

J2
V2
C3
C5
C4
L1
J1
V1
R2
R4
L5
R5
L3
C11
C1
R1
TB2
C2
C12
L4
C7
C14
P1

Figure 5-55. Amplifier-Converter-Modulator AM-2064/URC, Carrier Generator Module, Front View, Cover Removed

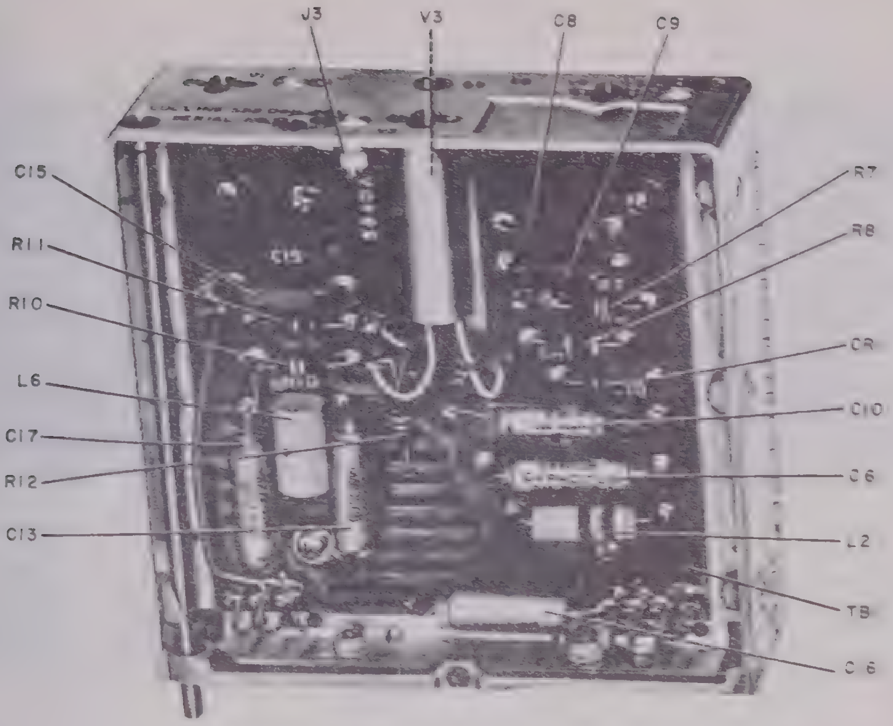

J3
V3
C8
C9
C15
R11
R10
L6
C17
R12
C13
R7
R8
CR
C10
C6
L2
TB
C16

Figure 5-56. Amplifier-Converter-Modulator AM-2064/URC, Carrier Generator Module, Rear View, Cover Removed

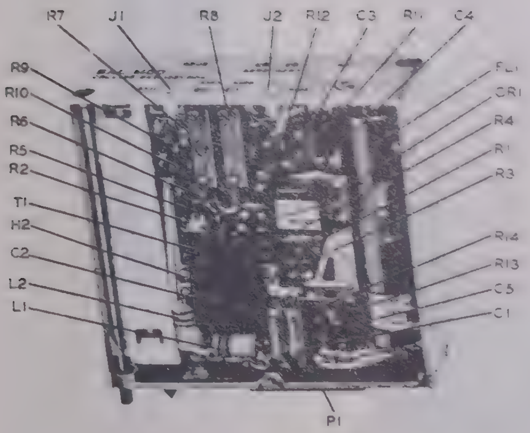

R7
J1
R8
J2
R12
C3
R11
C4
R9
R10
R6
R5
R2
T1
H2
C2
L2
L1
FL1
CR1
R4
R1
R3
R14
R13
C5
C1
P1

Figure 5-57. Amplifier-Converter-Modulator AM-2064/URC, Balanced Modulator Module, USB Modulator Assembly A1, Cover Removed

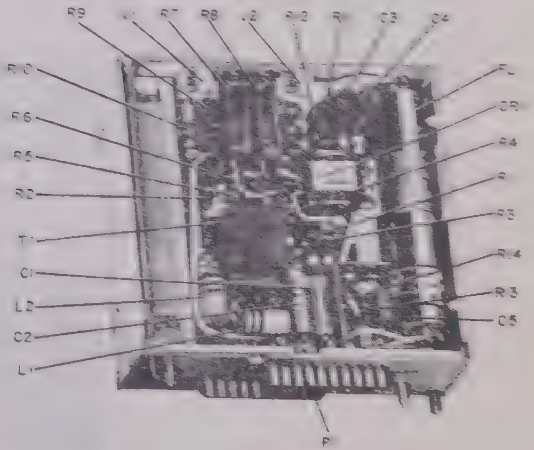

R9
R7
R8
R12
C3
C4
R10
R6
R5
R2
T1
C1
L2
C2
L1
FL
CR
R4
R3
R14
R13
C5
P

Figure 5-58. Amplifier-Converter-Modulator AM-2064/URC, Balanced Modulator Module, LSB Modulator Assembly A2, Cover Removed

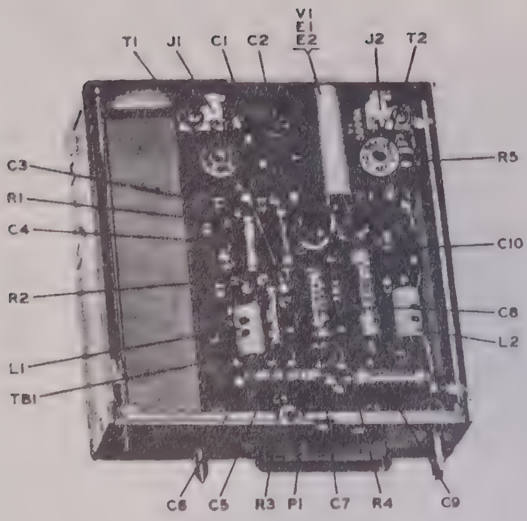

T1
J1
C1
C2
V1
E1
E2
J2
T2
R5
C3
R1
C4
C10
R2
C8
L2
L1
TB1
C6
C5
R3
P1
C7
R4
C9

Figure 5-59. Amplifier-Converter-Modulator AM-2064/URC, TGC Module and TGC-VOX Anti-VOX Module, TGC Assembly, Cover Removed (For Information Only, Not Supplied with AN/URC-32 ( ))

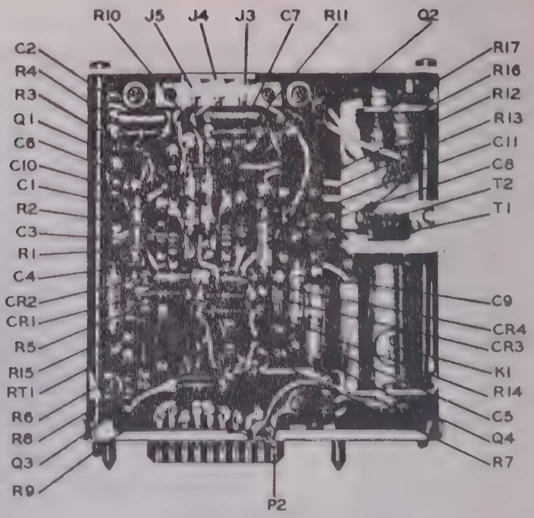

R10
J5
J4
J3
C7
R11
Q2
C2
R4
R3
Q1
C6
C10
C1
R2
C3
R1
C4
CR2
CR1
R5
R15
RT1
R6
R8
Q3
R9
R17
R16
R12
R13
C11
C8
T2
T1
C9
CR4
CR3
K1
R14
C5
Q4
R7
P2

Figure 5-60. Amplifier-Converter-Modulator AM-2064/URC, TGC-VOX Anti-VOX Module, VOX Anti-VOX Assembly, Cover Removed (For Information Only, Not Supplied with AN/URC-32 ( ))

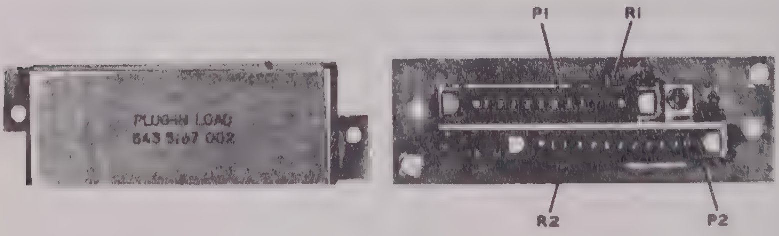

PLUG-IN LOAD
543 5167 002
P1
R1
R2
P2

Figure 5-61. Amplifier-Converter-Modulator AM-2064/URC, Balanced Modulator Dummy Plug, Cover Removed (For Information Only, Not Supplied with AN/URC-32 ( ))

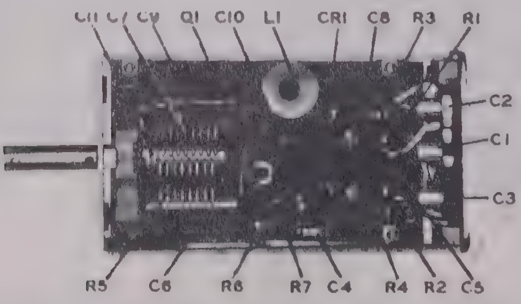

C11
C7
C9
Q1
C10
L1
CR1
C8
R3
R1
C2
C1
C3
R5
C6
R6
R7
C4
R4
R2
C5

Figure 5-62. Converter-Monitor CV-730/URC, BFO Subassembly A1, Cover Removed

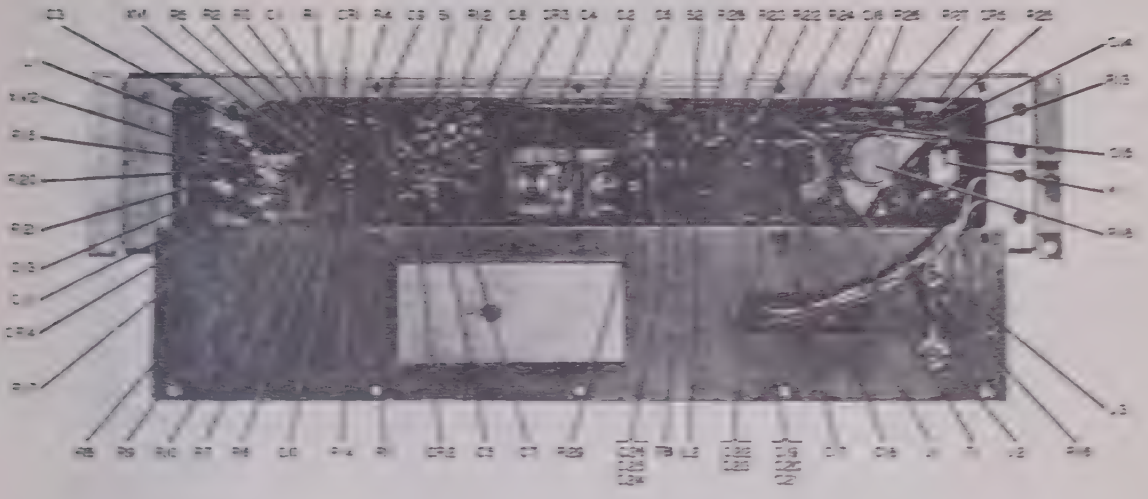

C3
XV1
R5
R2
C1
R1
CR1
R4
C9
S1
R12
C8
CR3
C4
C2
C5
S2
R28
R23
R22
R24
C6
R26
R27
CR5
R25
C14
R13
C15
R18
XV2
R15
R20
R21
C13
C11
CR4
R17
J3
R8
R9
R10
R7
R6
C10
R14
CR2
C7
R29
TB
C17
C16
J1
T1
V2
R16

Figure 5-63. Converter-Monitor CV-730/URC.
Rear View with Cover Removed

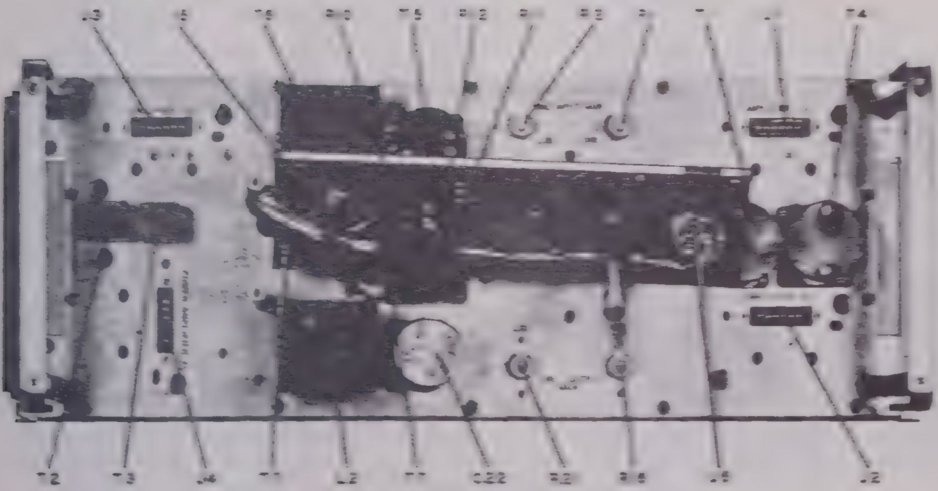

J3
T6
R10
T5
R12
R11
J1
T4
T2
T3
J4
T1
L2
C22
J5
J2

Figure 5-64. Amplifier-Control AM-2061/URC.
Chassis, Front View, Cover Removed

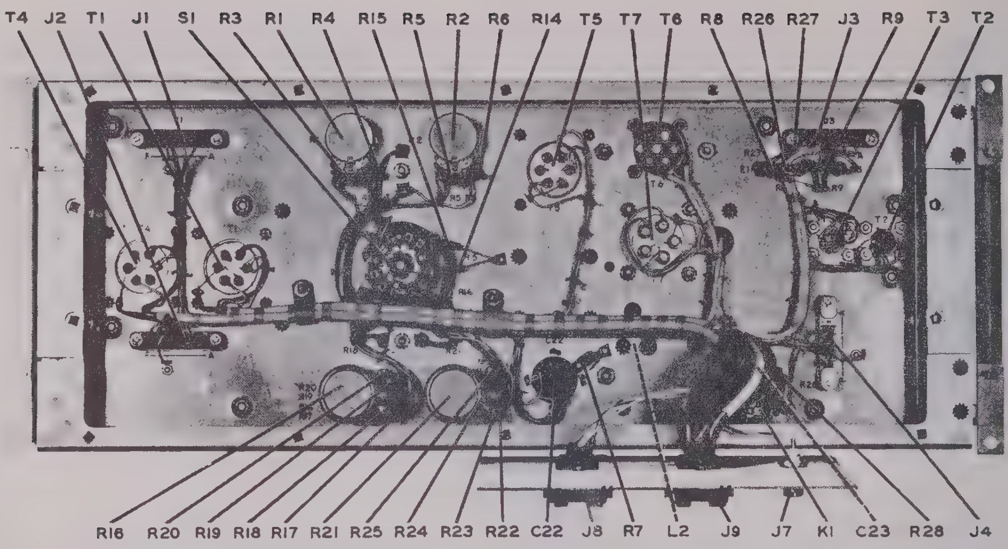

T4
J2
T1
J1
S1
R3
R1
R4
R15
R5
R2
R6
R14
T5
T7
T6
R8
R26
R27
J3
R9
T3
T2
R16
R20
R19
R18
R17
R21
R25
R24
R23
R22
C22
J8
R7
L2
J9
J7
K1
C23
R28
J4

Figure 5-65. Amplifier-Control AM-2062/URC, Chassis, Rear View, Cover Removed

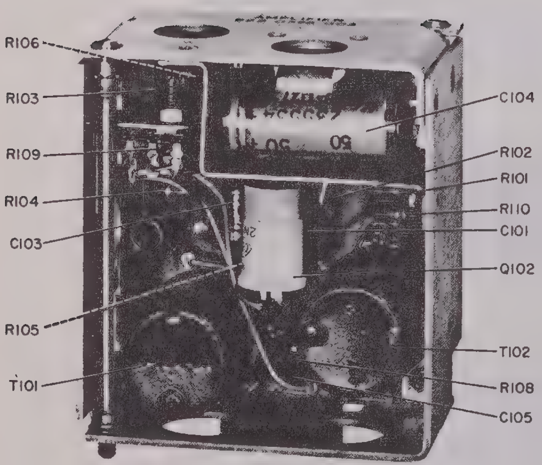

R106
R103
R109
R104
C103
R105
T101
C104
R102
R101
R110
C101
Q102
T102
R108
C105

Figure 5-66. Amplifier-Control AM-2062/URC, Mike or Line Amplifier Module, Component Side, Cover Removed

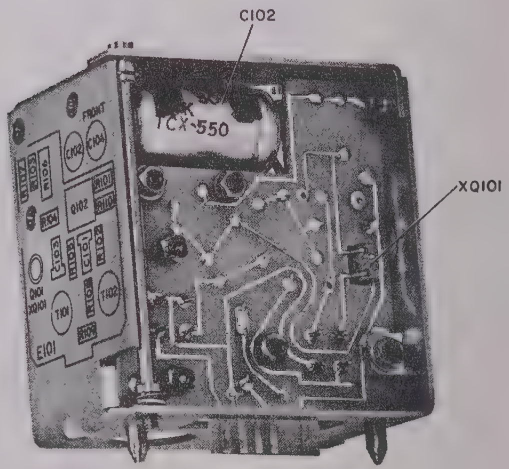


Figure 5-67. Amplifier-Control AM-2062/URC, Mike or Line Amplifier Module, Wiring Side, Cover Removed

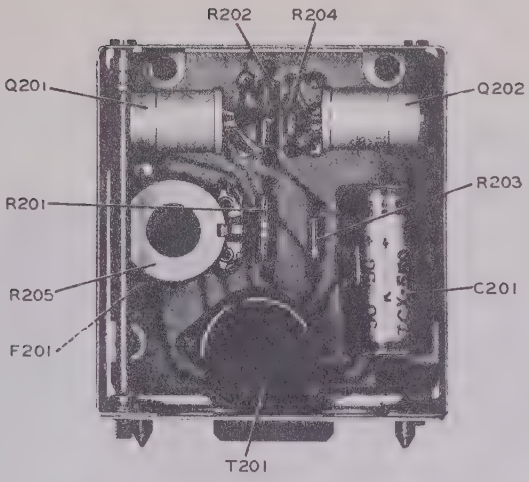

R202
R204
Q201
Q202
R203
R201
R205
C201
F201
T201

Figure 5-68. Amplifier-Control AM-2062/URC, Speaker Amplifier Module, Component Side, Cover Removed

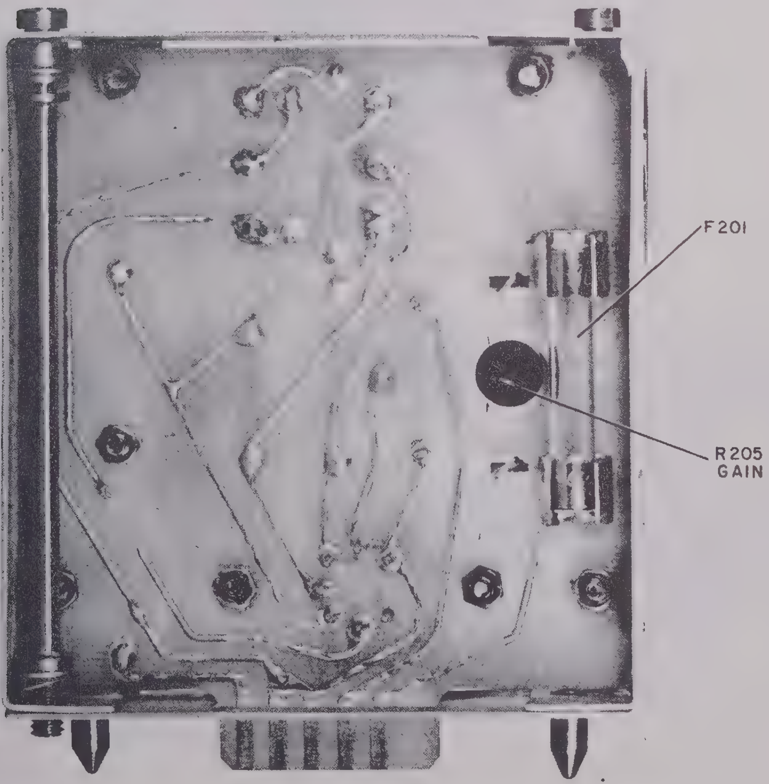

F201
R205
GAIN

Figure 5-69. Amplifier-Control AM-2062/URC, Speaker Amplifier Module, Wiring Side, Cover Removed

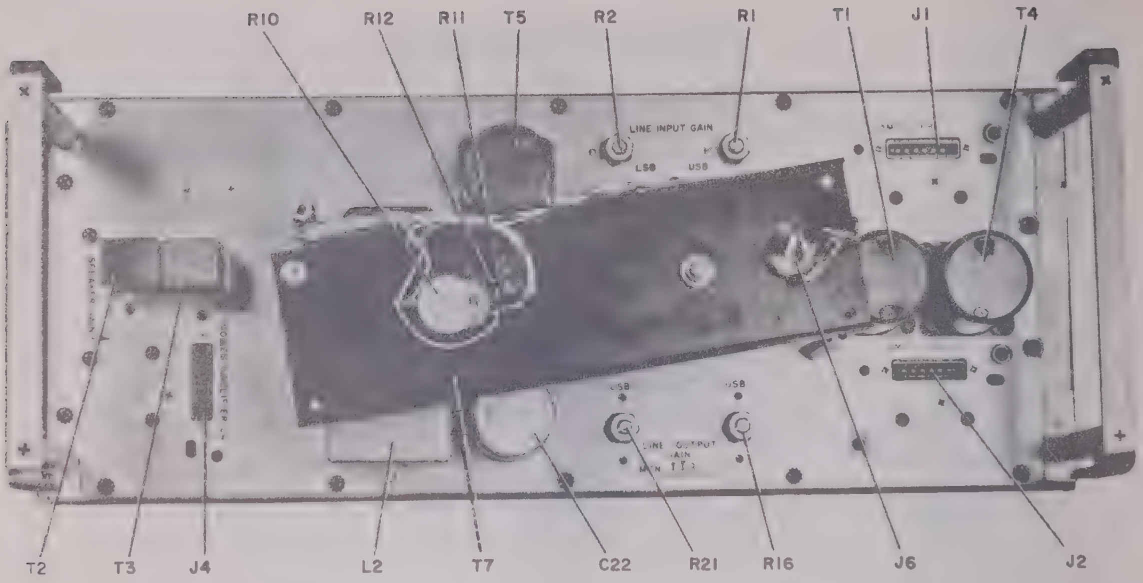

R10
R12
R11
T5
R2
R1
T1
J1
T4
LINE INPUT GAIN
LSB
USB
USB
USB
LINE OUTPUT GAIN
T2
T3
J4
L2
T7
C22
R21
R16
J6
J2

Figure 5-70. Amplifier-Control AM-2062A/URC, Chassis, Front View, Cover Removed

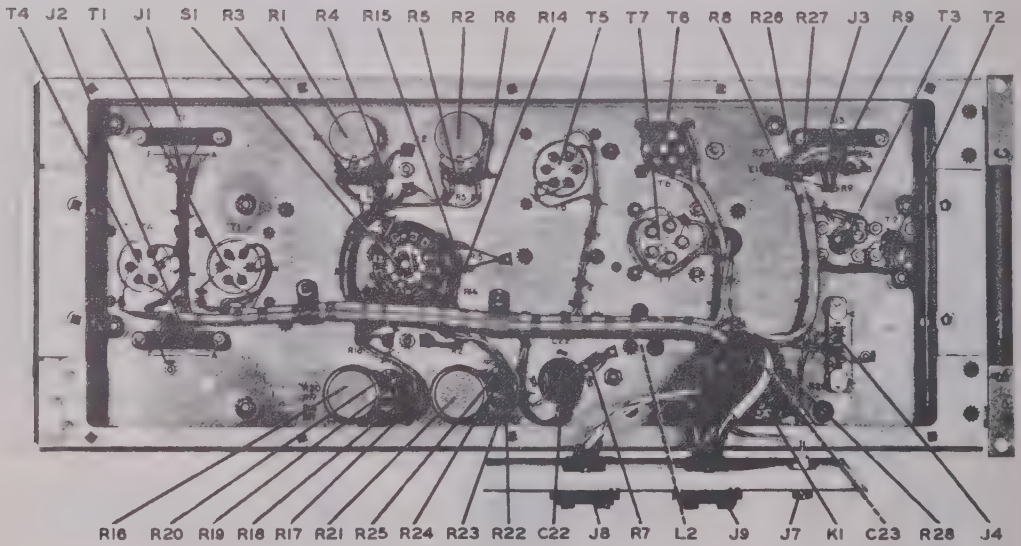

T4
J2
T1
J1
S1
R3
R1
R4
R15
R5
R2
R6
R14
T5
T7
T6
R8
R26
R27
J3
R9
T3
T2
R16
R20
R19
R18
R17
R21
R25
R24
R23
R22
C22
J8
R7
L2
J9
J7
K1
C23
R28
J4

Figure 5-71. Amplifier-Control AM-2062A/URC, Chassis, Rear View, Cover Removed

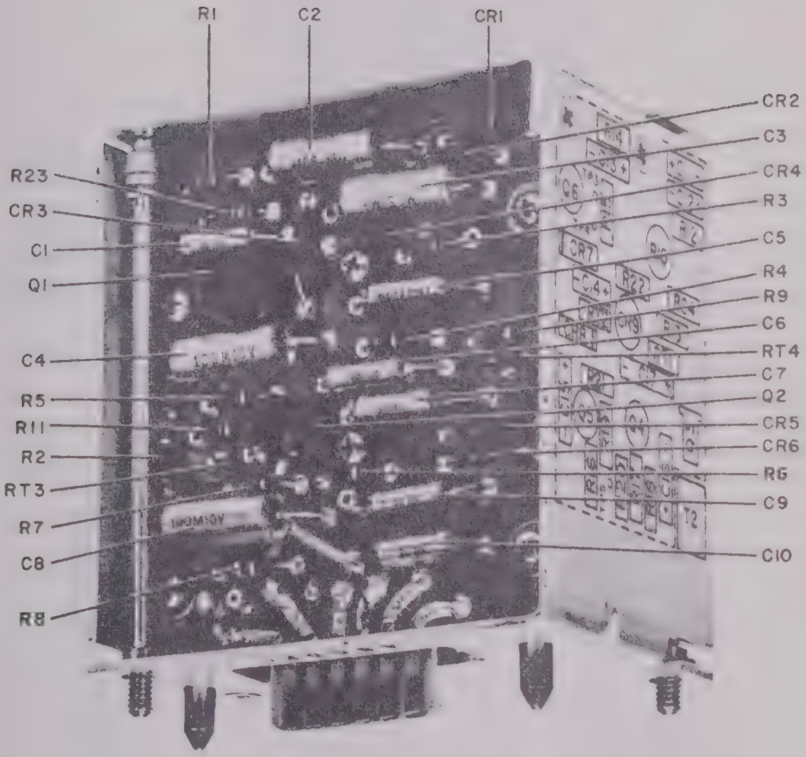

R1
C2
CR1
CR2
C3
CR4
R3
C5
R4
R9
C6
RT4
C7
Q2
CR5
CR6
R6
C9
C10
R23
CR3
C1
Q1
C4
R5
R11
R2
RT3
R7
C8
R8

Figure 5-72. Amplifier-Control AM-2062A/URC, Line Amplifier Module, Top View, Cover Removed

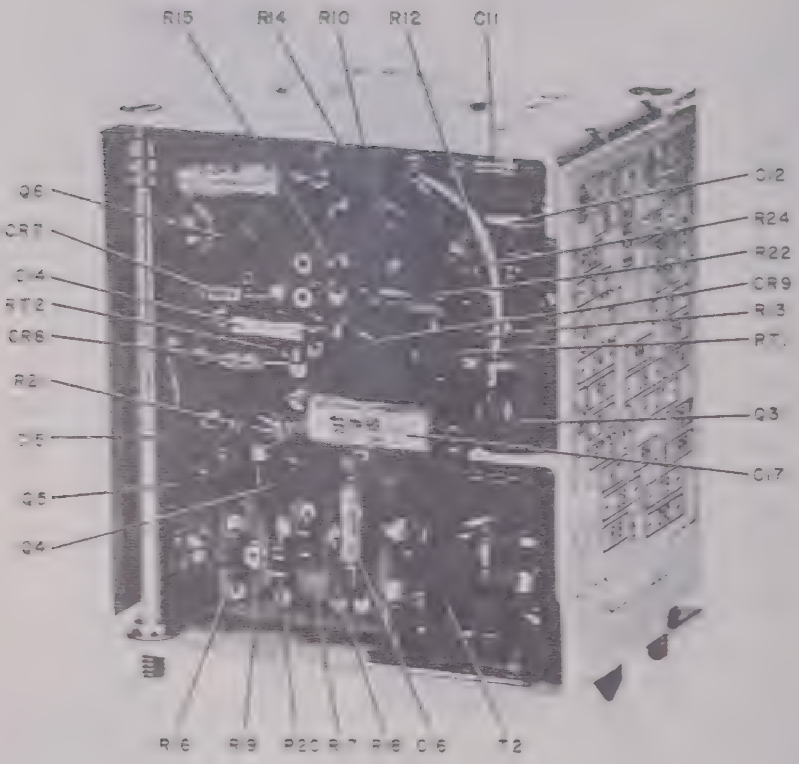

R15
R14
R10
R12
C11
Q6
CR7
C14
RT2
CR8
R2
C15
Q5
Q4
C12
R24
R22
CR9
R13
RT1
Q3
C17
R16
R19
R20
R17
R18
C16
T2

Figure 5-73. Amplifier-Control AM-2062A/URC, Line Amplifier Module, Bottom View, Cover Removed

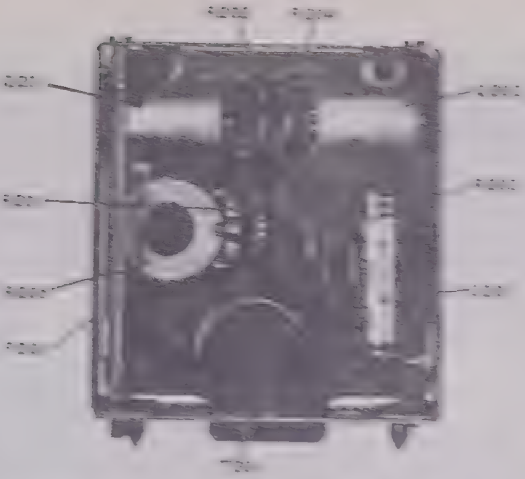


Figure 5-74. Amplifier-Control AM-2062A/TRC, Speaker Amplifier Module, Component Side, Cover Removed

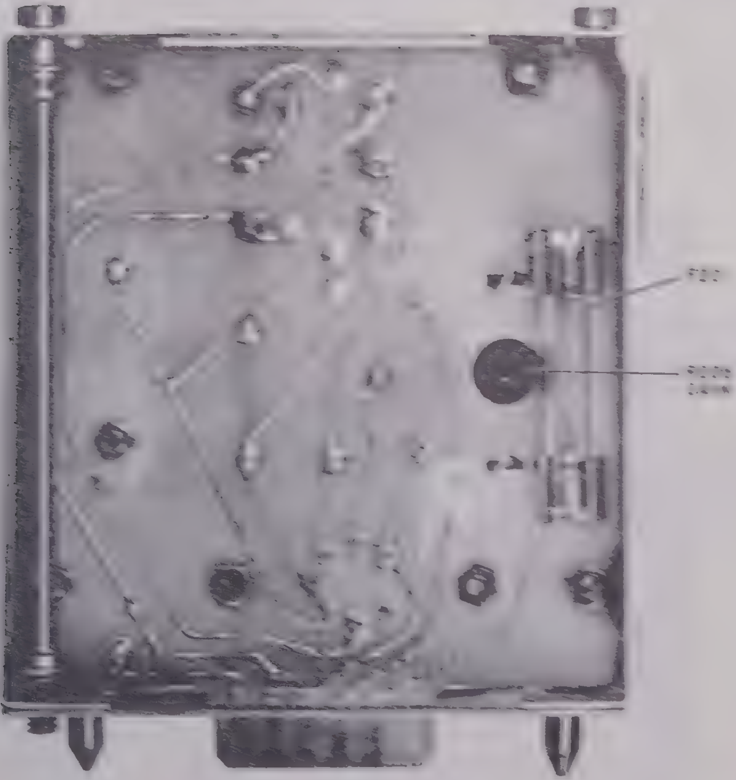


Figure 5-75. Amplifier-Control AM-2062A/TRC, Speaker Amplifier Module, Wiring Side, Cover Removed

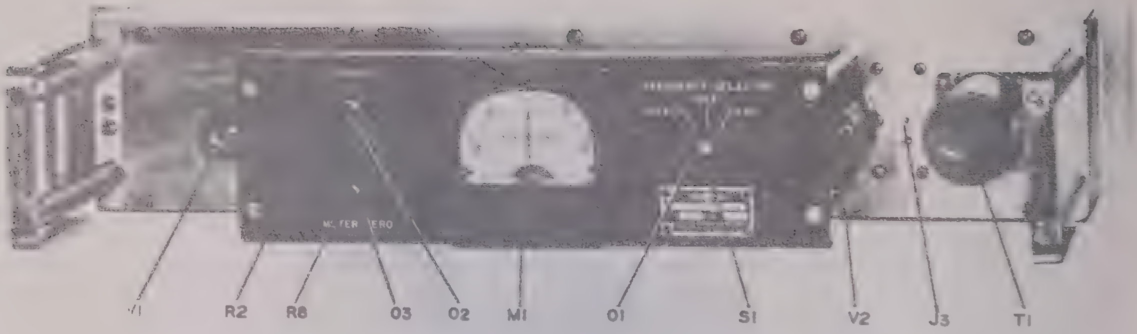

V1
R2
R8
O3
O2
M1
O1
S1
V2
J3
T1
METER ZERO

Figure 5-76. Signal Comparator CM-126/UR, Front View with Cover Removed

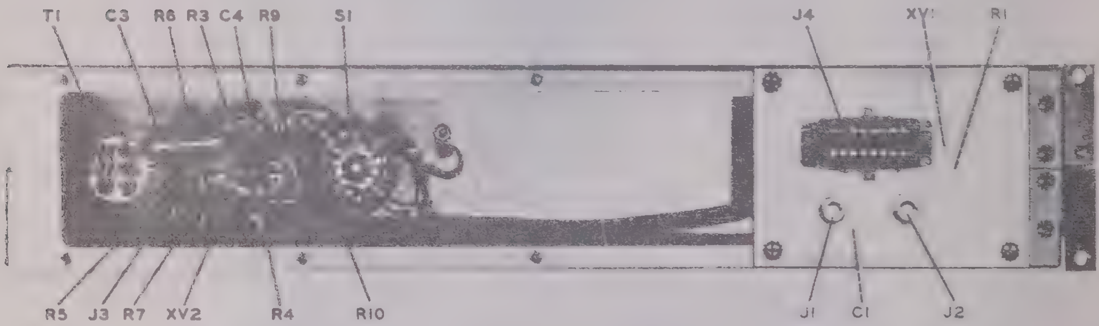

T1
C3
R6
R3
C4
R9
S1
J4
XV1
R1
R5
J3
R7
XV2
R4
R10
J1
C1
J2

Figure 5-77. Signal Comparator CM-126/UR, Rear View with Cover Removed

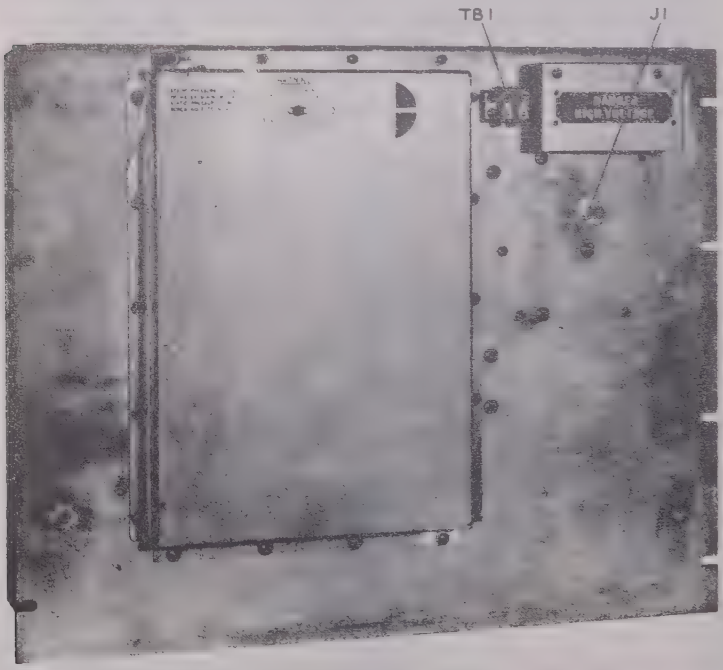


Figure 5-78. Power Supply PP-2153/U, Rear View

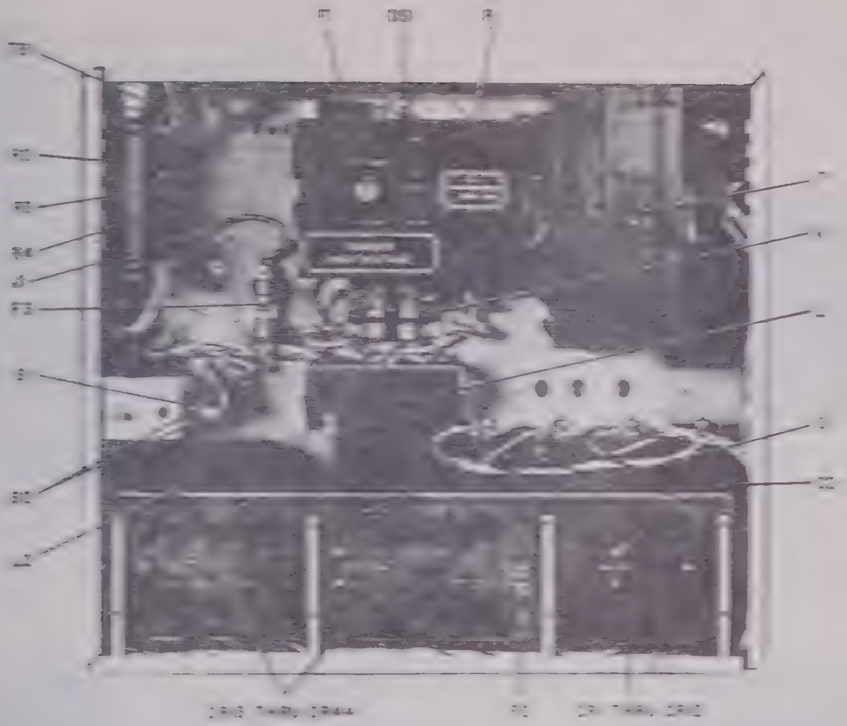


Figure 5-79. Power Supply PP-2153/U
Front View, Cover Removed

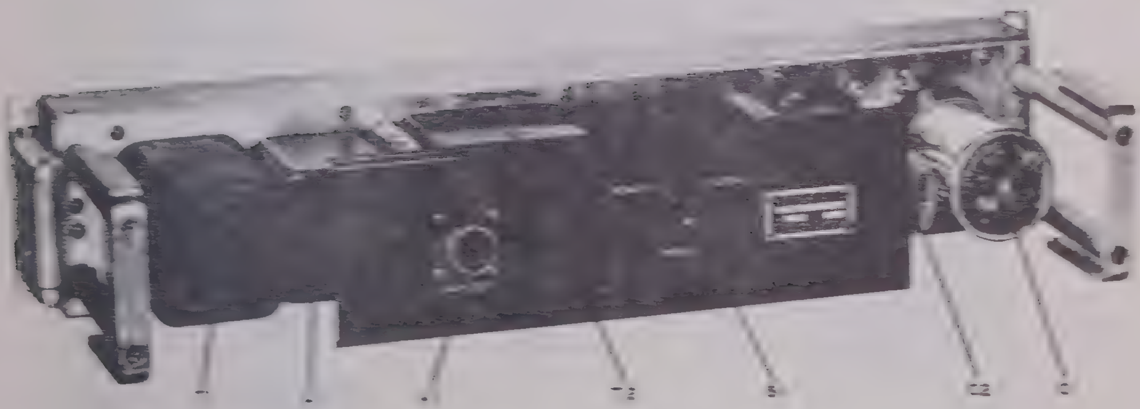


Figure 5-80. Control-Power Supply C-2891/URC
Front View with Cover Removed

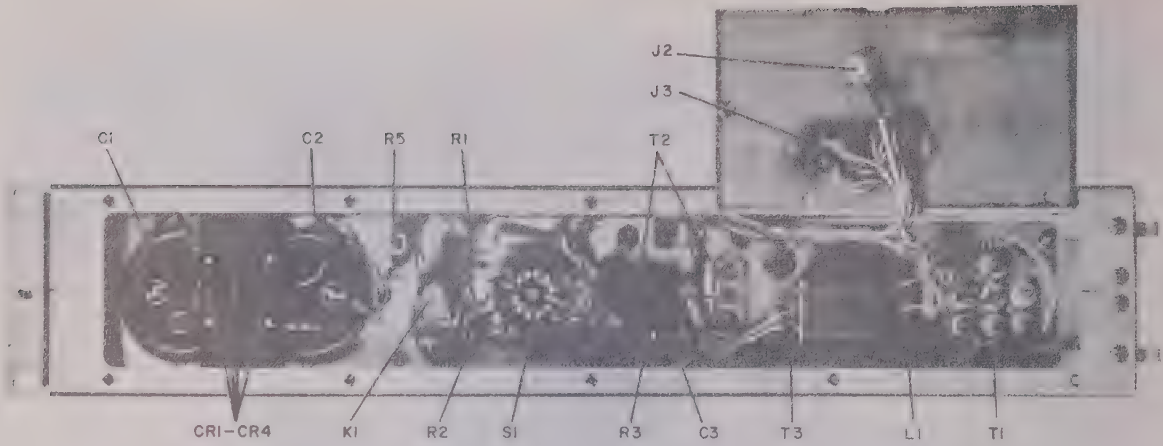

J2
J3
C1
C2
R5
R1
T2
CR1-CR4
K1
R2
S1
R3
C3
T3
L1
T1

Figure 5-81. Control-Power Supply C-2691/URC, Rear View with Cover Removed

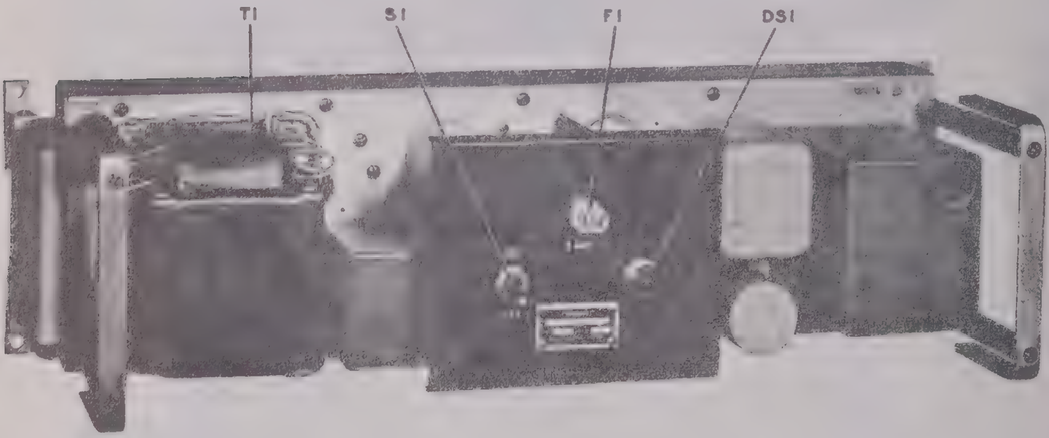


Figure 5-82. Power Supply PP-2154/U, Front View with Cover Removed

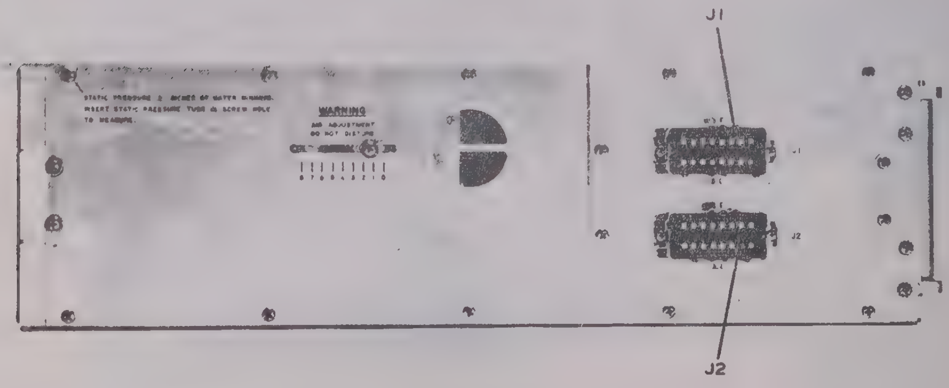

J1
WARNING
J2

Figure 5-83. Power Supply PP-2154/U, Rear View

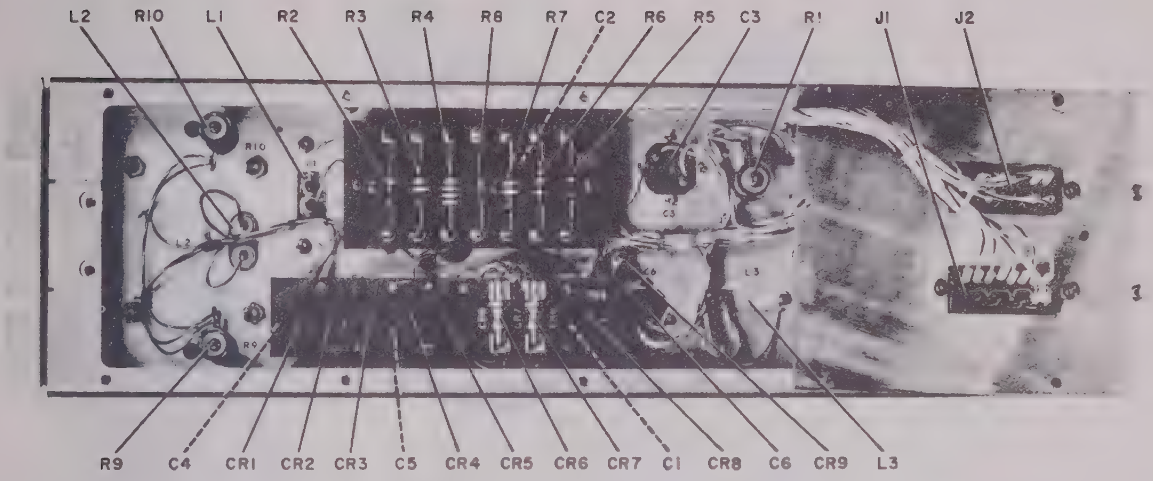

L2
R10
L1
R2
R3
R4
R8
R7
C2
R6
R5
C3
R1
J1
J2
R9
C4
CR1
CR2
CR3
C5
CR4
CR5
CR6
CR7
C1
CR8
C6
CR9
L3

Figure 5-84. Power Supply PP-2154/U,
Rear View with Cover Removed

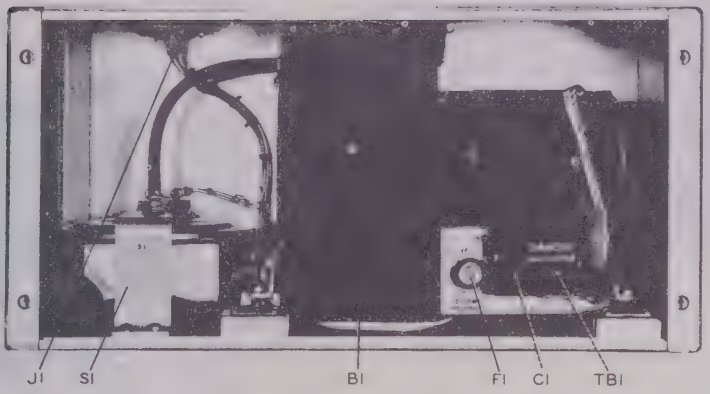

J1
S1
B1
F1
C1
TB1

Figure 5-85. Electronic Equipment Air Cooler HD-347/U,
Front Cover and Filter Removed

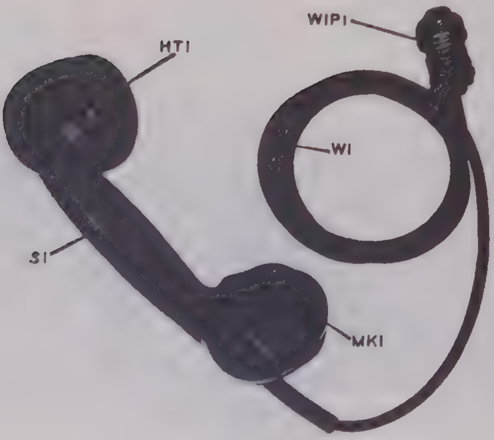

WIPI
HTI
WI
SI
MKI

Figure 5-86. Dynamic Handset H-169/U
and Cord CX-1846A/U

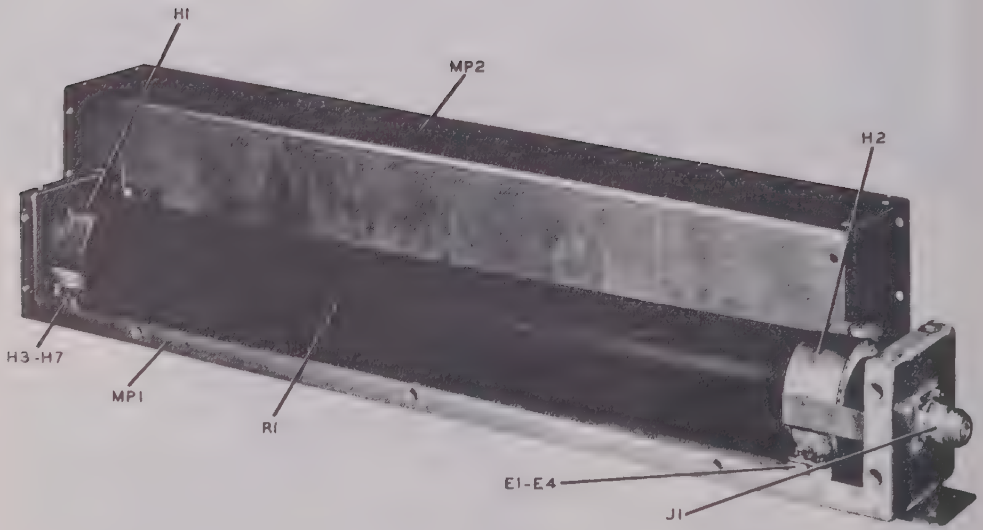
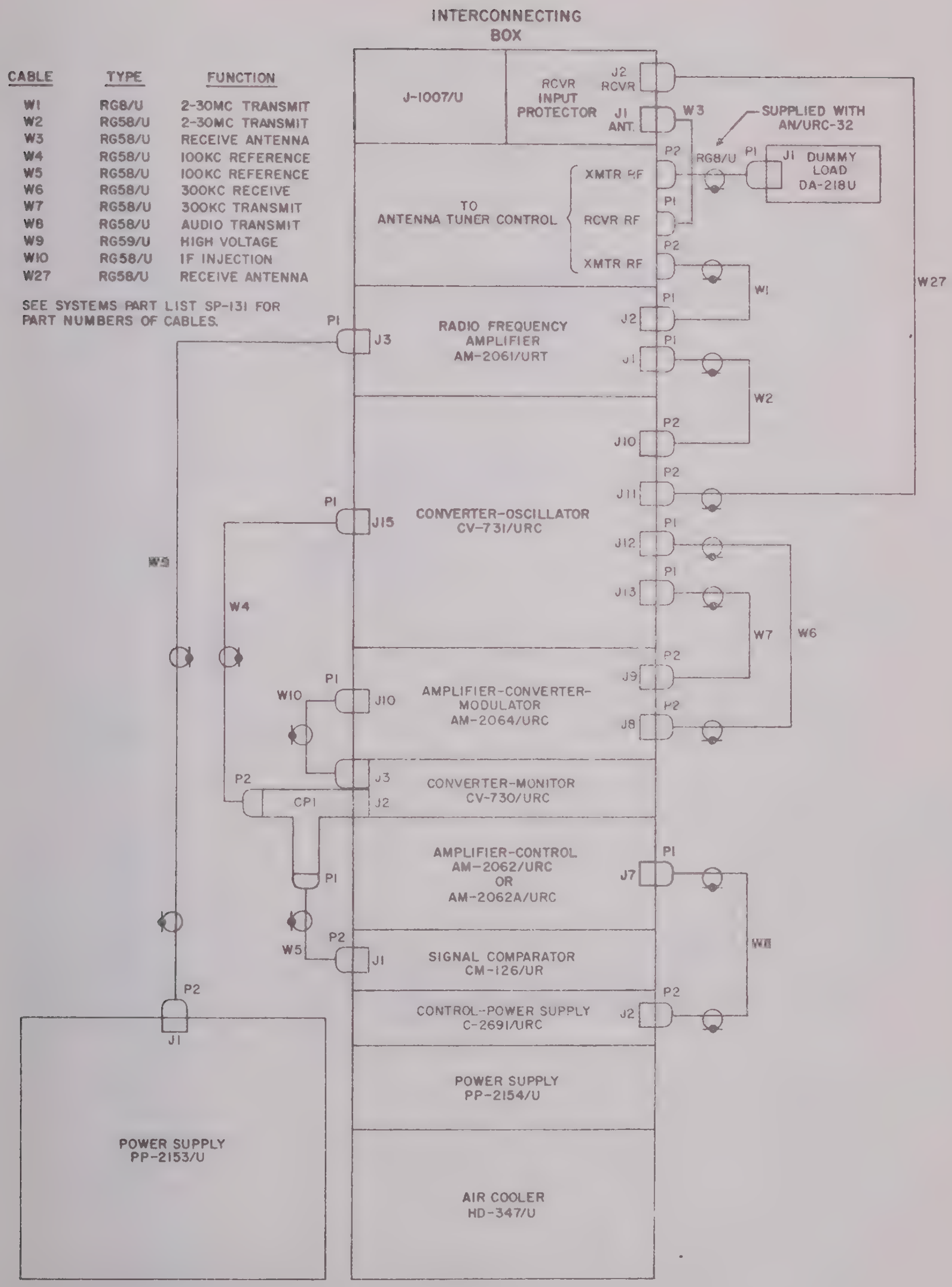

HI
MP2
H2
H3-H7
MPI
RI
EI-E4
JI

Figure 5-87. Electrical Dummy Load DA-218/U
with Cover Removed



CABLE	TYPE	FUNCTION
W1	RG8/U	2-30MC TRANSMIT
W2	RG58/U	2-30MC TRANSMIT
W3	RG58/U	RECEIVE ANTENNA
W4	RG58/U	100KC REFERENCE
W5	RG58/U	100KC REFERENCE
W6	RG58/U	300KC RECEIVE
W7	RG58/U	300KC TRANSMIT
W8	RG58/U	AUDIO TRANSMIT
W9	RG59/U	HIGH VOLTAGE
W10	RG58/U	IF INJECTION
W27	RG58/U	RECEIVE ANTENNA

SEE SYSTEMS PART LIST SP-131 FOR PART NUMBERS OF CABLES.

INTERCONNECTING BOX
J-1007/U
RCVR INPUT PROTECTOR
J2 RCVR
J1 ANT.
W3
SUPPLIED WITH AN/URC-32
RG8/U
P1
J1
DUMMY LOAD DA-218U
TO ANTENNA TUNER CONTROL
XMTR RF
RCVR RF
XMTR RF
P2
P1
P2
W1
W27
RADIO FREQUENCY AMPLIFIER AM-2061/URT
P1
J3
J2
J1
W2
CONVERTER-OSCILLATOR CV-731/URC
J10
J11
J12
J13
J15
W9
W4
W7
W6
AMPLIFIER-CONVERTER-MODULATOR AM-2064/URC
W10
J10
J9
J8
CONVERTER-MONITOR CV-730/URC
J3
J2
CP1
AMPLIFIER-CONTROL AM-2062/URC OR AM-2062A/URC
J7
W8
SIGNAL COMPARATOR CM-126/UR
W5
J1
CONTROL-POWER SUPPLY C-2691/URC
J2
POWER SUPPLY PP-2154/U
AIR COOLER HD-347/U
POWER SUPPLY PP-2153/U
J1

Figure 5-88. Radio Set AN/URC-32( ), Coaxial Interunit Connections Diagram

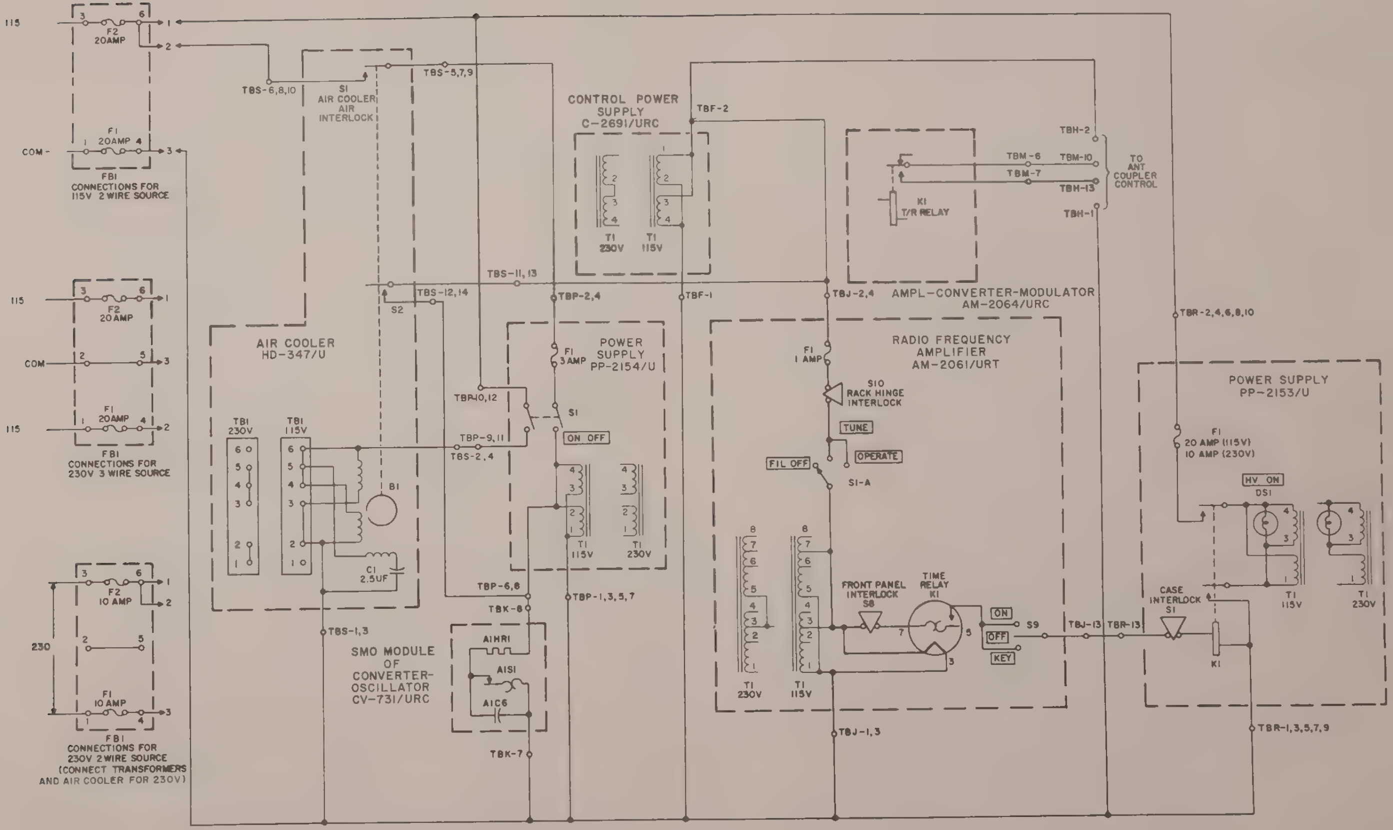

115
3
6
F2
20AMP
1
2
TBS-6,8,10
S1
AIR COOLER
AIR
INTERLOCK
TBS-5,7,9
F1
20AMP
1
4
COM -
3
FB1
CONNECTIONS FOR
115V 2 WIRE SOURCE
CONTROL POWER
SUPPLY
C-2691/URC
TBF-2
T1
230V
T1
115V
TBH-2
TBM-6
TBM-10
TBM-7
TBH-13
TBH-1
K1
T/R RELAY
TO
ANT
COUPLER
CONTROL
115
F2
20 AMP
COM
F1
20AMP
115
FB1
CONNECTIONS FOR
230V 3 WIRE SOURCE
TBS-11, 13
TBS-12,14
S2
TBP-2,4
TBF-1
TBJ-2,4
AMPL-CONVERTER-MODULATOR
AM-2064/URC
TBR-2,4,6,8,10
AIR COOLER
HD-347/U
TB1
230V
TB1
115V
B1
C1
2.5UF
F1
3 AMP
POWER
SUPPLY
PP-2154/U
TBP10,12
S1
ON OFF
TBP-9,11
TBS-2,4
T1
115V
T1
230V
RADIO FREQUENCY
AMPLIFIER
AM-2061/URT
F1
1 AMP
S10
RACK HINGE
INTERLOCK
TUNE
OPERATE
FIL OFF
S1-A
POWER SUPPLY
PP-2153/U
F1
20 AMP (115V)
10 AMP (230V)
HV ON
DS1
F2
10 AMP
230
F1
10 AMP
FB1
CONNECTIONS FOR
230V 2 WIRE SOURCE
(CONNECT TRANSFORMERS
AND AIR COOLER FOR 230V)
TBP-6,8
TBK-8
TBS-1,3
TBP-1,3,5,7
SMO MODULE
OF
CONVERTER-
OSCILLATOR
CV-731/URC
A1HR1
A1S1
A1C6
TBK-7
T1
230V
T1
115V
FRONT PANEL
INTERLOCK
S8
TIME
RELAY
K1
ON
OFF
KEY
S9
TBJ-13
TBR-13
CASE
INTERLOCK
S1
K1
T1
115V
T1
230V
TBJ-1,3
TBR-1,3,5,7,9

Figure 5-89. Radio Set AN/URC-32( ), Primary Power Distribution Schematic Diagram

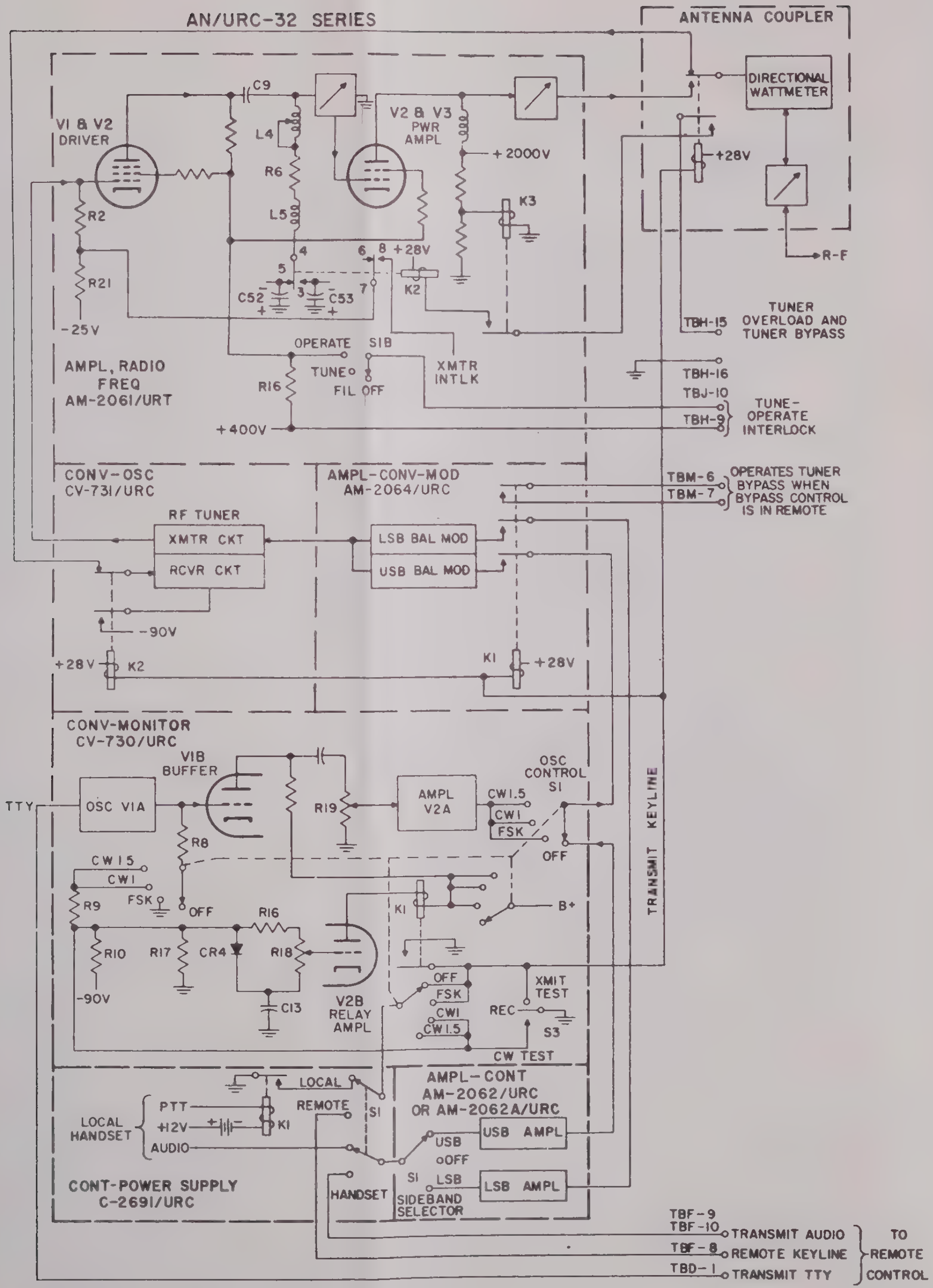

AN/URC-32 SERIES
ANTENNA COUPLER
DIRECTIONAL WATTMETER
+28V
R-F
C9
V1 & V2
DRIVER
L4
R6
L5
V2 & V3
PWR
AMPL
+2000V
K3
R2
R21
-25V
4
5
6
8
+28V
7
3
C52
C53
K2
TBH-15
TUNER
OVERLOAD AND
TUNER BYPASS
OPERATE
S1B
TUNE
FIL OFF
XMTR
INTLK
R16
AMPL, RADIO
FREQ
AM-2061/URT
+400V
TBH-16
TBJ-10
TBH-9
TUNE-
OPERATE
INTERLOCK
CONV-OSC
CV-731/URC
AMPL-CONV-MOD
AM-2064/URC
TBM-6
TBM-7
OPERATES TUNER
BYPASS WHEN
BYPASS CONTROL
IS IN REMOTE
RF TUNER
XMTR CKT
RCVR CKT
LSB BAL MOD
USB BAL MOD
-90V
+28V
K2
K1
+28V
CONV-MONITOR
CV-730/URC
V1B
BUFFER
TTY
OSC V1A
R8
R19
AMPL
V2A
CW1.5
CW1
FSK
OSC
CONTROL
S1
OFF
TRANSMIT KEYLINE
CW1.5
CW1
FSK
OFF
R9
R16
K1
B+
R10
R17
CR4
R18
-90V
C13
V2B
RELAY
AMPL
OFF
FSK
CW1
CW1.5
XMIT
TEST
REC
S3
CW TEST
LOCAL
REMOTE
S1
AMPL-CONT
AM-2062/URC
OR AM-2062A/URC
PTT
LOCAL
HANDSET
+12V
K1
AUDIO
USB AMPL
USB
OFF
S1
LSB
LSB AMPL
HANDSET
SIDEBAND
SELECTOR
CONT-POWER SUPPLY
C-2691/URC
TBF-9
TBF-10
TRANSMIT AUDIO
TBF-8
REMOTE KEYLINE
TBD-1
TRANSMIT TTY
TO
REMOTE
CONTROL

Figure 5-90. Radio Set AN/URC-32( ), Transmit Control Circuit Schematic Diagram

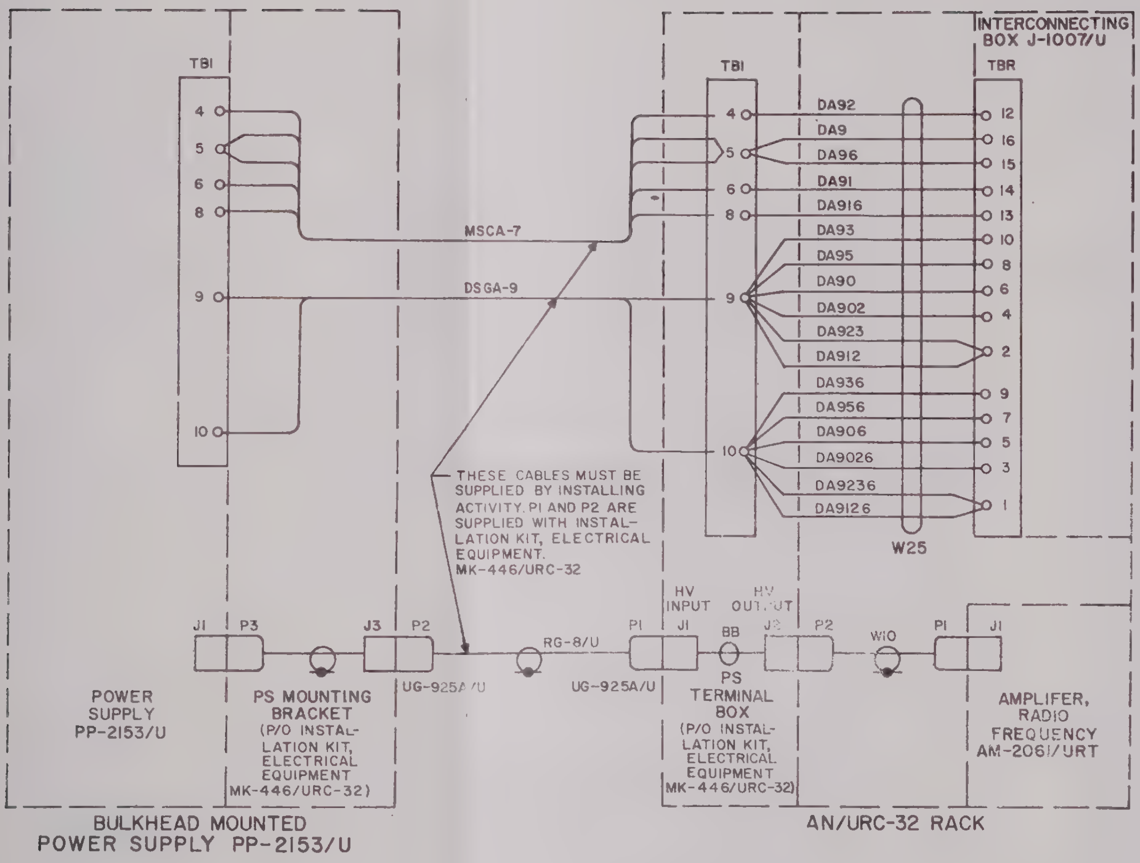
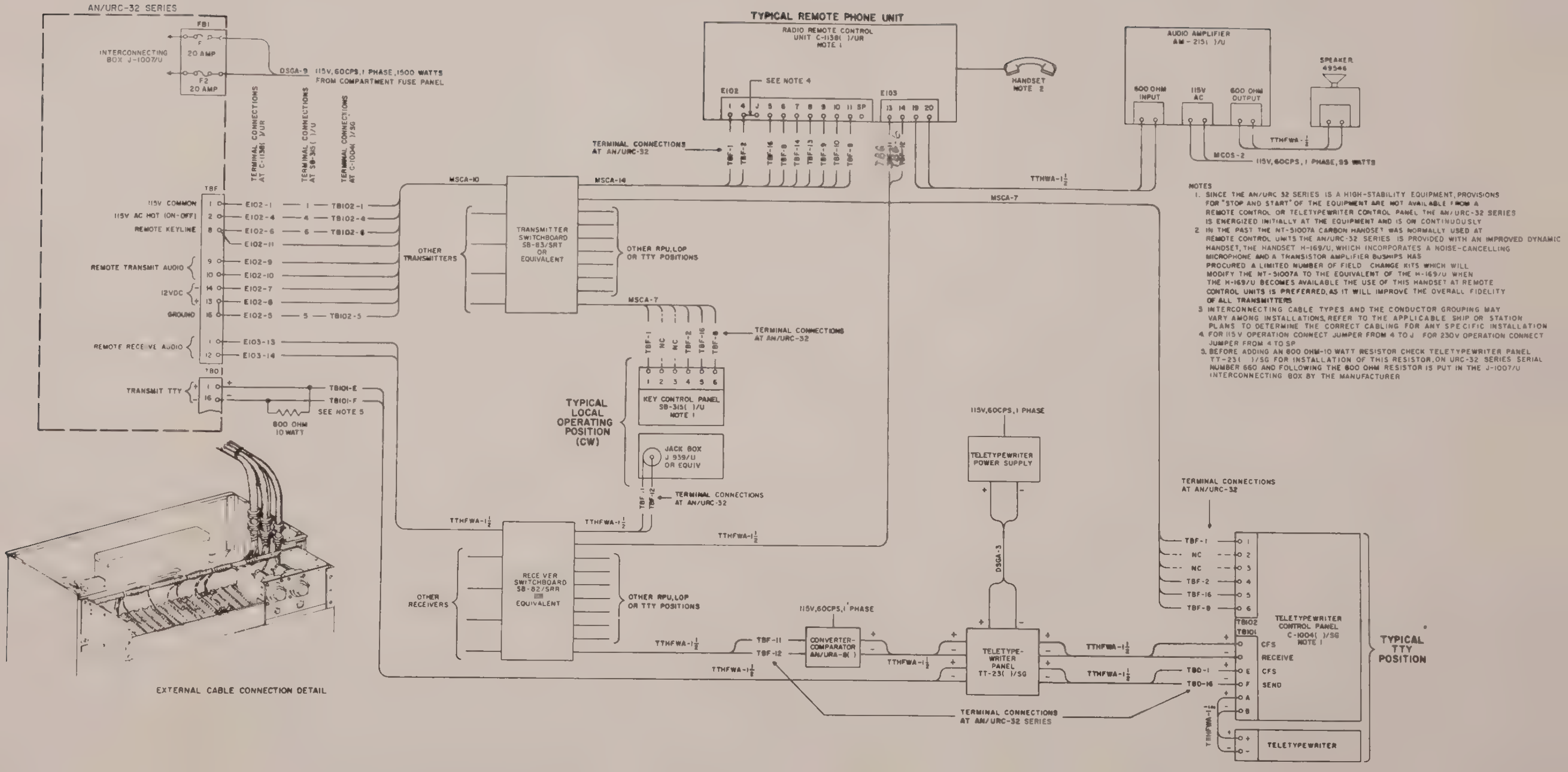

TBI
4
5
6
8
9
10
MSCA-7
DSGA-9
TBI
4
5
6
8
9
10
INTERCONNECTING
BOX J-1007/U
TBR
DA92
DA9
DA96
DA91
DA916
DA93
DA95
DA90
DA902
DA923
DA912
DA936
DA956
DA906
DA9026
DA9236
DA9126
12
16
15
14
13
10
8
6
4
2
9
7
5
3
1
W25
THESE CABLES MUST BE SUPPLIED BY INSTALLING ACTIVITY. PI AND P2 ARE SUPPLIED WITH INSTALLATION KIT, ELECTRICAL EQUIPMENT. MK-446/URC-32
HV
INPUT
HV
OUTPUT
JI
P3
J3
P2
RG-8/U
PI
JI
BB
J2
P2
WIO
PI
JI
UG-925A/U
UG-925A/U
POWER
SUPPLY
PP-2153/U
PS MOUNTING
BRACKET
(P/O INSTALLATION KIT,
ELECTRICAL
EQUIPMENT
MK-446/URC-32)
PS
TERMINAL
BOX
(P/O INSTALLATION KIT,
ELECTRICAL
EQUIPMENT
MK-446/URC-32)
AMPLIFER,
RADIO
FREQUENCY
AM-2061/URT
BULKHEAD MOUNTED
POWER SUPPLY PP-2153/U
AN/URC-32 RACK

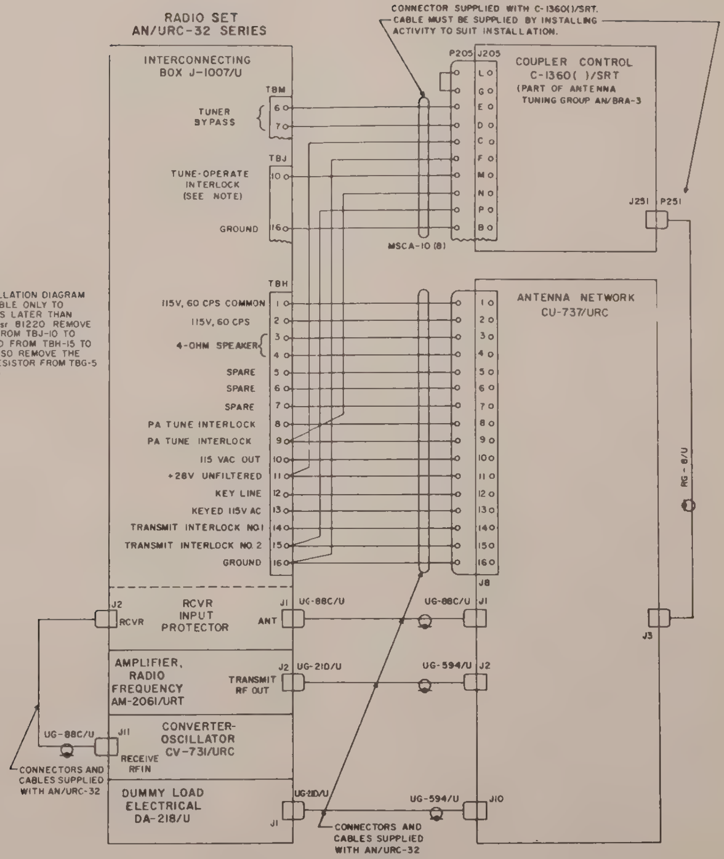
Figure 5-91. Radio Set AN/URC-32( ), Power Supply PP-2153/U, Bulkhead Mounting Cable Diagram


AN/URC-32 SERIES
FB1
F
20 AMP
F2
20 AMP
INTERCONNECTING BOX J-1007/U
DSGA-9
115V, 60CPS, 1 PHASE, 1500 WATTS FROM COMPARTMENT FUSE PANEL
TERMINAL CONNECTIONS AT C-1138( )/UR
TERMINAL CONNECTIONS AT SB-315( )/U
TERMINAL CONNECTIONS AT C-1004( )/SG
TBF
115V COMMON
115V AC HOT (ON-OFF)
REMOTE KEYLINE
REMOTE TRANSMIT AUDIO
12VDC
GROUND
REMOTE RECEIVE AUDIO
E102-1
E102-4
E102-6
E102-11
E102-9
E102-10
E102-7
E102-8
E102-5
E103-13
E103-14
TB102-1
TB102-4
TB102-6
TB102-5
TBO
TRANSMIT TTY
TB101-E
TB101-F
SEE NOTE 5
800 OHM 10 WATT
EXTERNAL CABLE CONNECTION DETAIL
MSCA-10
MSCA-14
MSCA-7
OTHER TRANSMITTERS
TRANSMITTER SWITCHBOARD SB-83/SRT OR EQUIVALENT
OTHER RPU, LOP OR TTY POSITIONS
TYPICAL REMOTE PHONE UNIT
RADIO REMOTE CONTROL UNIT C-1138( )/UR NOTE 1
SEE NOTE 4
E102
E103
1 4 J 5 6 7 8 9 10 11 SP
13 14 19 20
TERMINAL CONNECTIONS AT AN/URC-32
TBF-1
TBF-2
TBF-16
TBF-8
TBF-14
TBF-13
TBF-9
TBF-10
TBF-11
TBF-12
HANDSET NOTE 2
AUDIO AMPLIFIER AM-215( )/U
600 OHM INPUT
115V AC
600 OHM OUTPUT
SPEAKER 49546
TTHFWA-1/2
MCOS-2
115V, 60CPS, 1 PHASE, 95 WATTS
TTHWA-1 1/2
NC
1 2 3 4 5 6
KEY CONTROL PANEL SB-315( )/U NOTE 1
TYPICAL LOCAL OPERATING POSITION (CW)
JACK BOX J 939/U OR EQUIV
TTHFWA-1 1/2
OTHER RECEIVERS
RECEIVER SWITCHBOARD SB-82/SRR OR EQUIVALENT
OTHER RPU, LOP OR TTY POSITIONS
115V, 60CPS, 1 PHASE
CONVERTER-COMPARATOR AN/URA-8( )
TELETYPEWRITER POWER SUPPLY
DSGA-3
TELETYPEWRITER PANEL TT-23( )/SG
TERMINAL CONNECTIONS AT AN/URC-32 SERIES
TBO-1
TBO-16
TB102
TB101
CFS
RECEIVE
CFS
SEND
A
B
TELETYPEWRITER CONTROL PANEL C-1004( )/SG NOTE 1
TELETYPEWRITER
TYPICAL TTY POSITION

NOTES

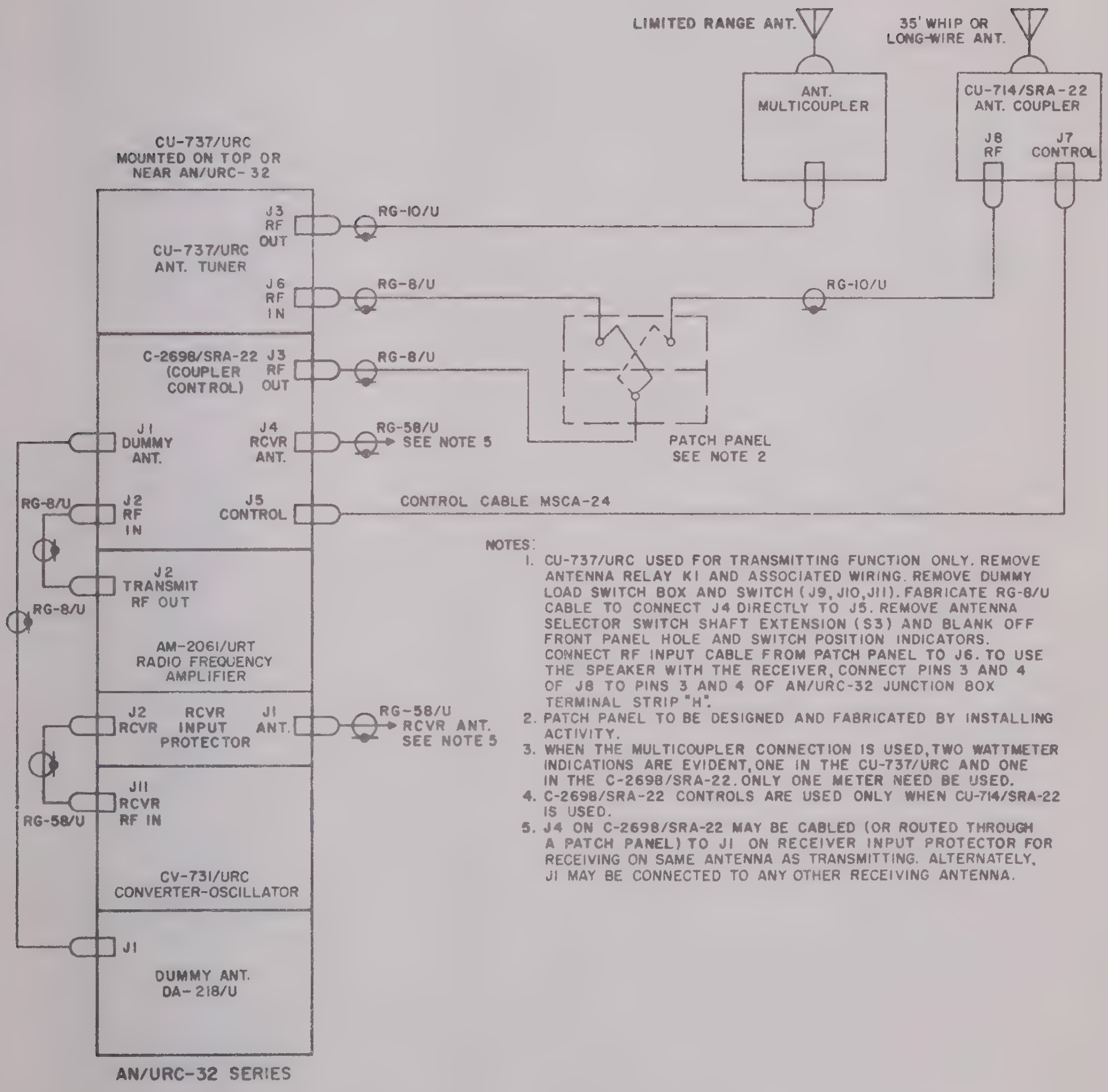
1. SINCE THE AN/URC 32 SERIES IS A HIGH-STABILITY EQUIPMENT, PROVISIONS FOR "STOP AND START" OF THE EQUIPMENT ARE NOT AVAILABLE FROM A REMOTE CONTROL OR TELETYPEWRITER CONTROL PANEL THE AN/URC-32 SERIES IS ENERGIZED INITIALLY AT THE EQUIPMENT AND IS ON CONTINUOUSLY
2. IN THE PAST THE NT-51007A CARBON HANDSET WAS NORMALLY USED AT REMOTE CONTROL UNITS THE AN/URC-32 SERIES IS PROVIDED WITH AN IMPROVED DYNAMIC HANDSET, THE HANDSET H-169/U, WHICH INCORPORATES A NOISE-CANCELLING MICROPHONE AND A TRANSISTOR AMPLIFIER BUSHIPS HAS PROCURED A LIMITED NUMBER OF FIELD CHANGE KITS WHICH WILL MODIFY THE NT-51007A TO THE EQUIVALENT OF THE H-169/U WHEN THE H-169/U BECOMES AVAILABLE THE USE OF THIS HANDSET AT REMOTE CONTROL UNITS IS PREFERRED, AS IT WILL IMPROVE THE OVERALL FIDELITY OF ALL TRANSMITTERS
3. INTERCONNECTING CABLE TYPES AND THE CONDUCTOR GROUPING MAY VARY AMONG INSTALLATIONS, REFER TO THE APPLICABLE SHIP OR STATION PLANS TO DETERMINE THE CORRECT CABLING FOR ANY SPECIFIC INSTALLATION
4. FOR 115V OPERATION CONNECT JUMPER FROM 4 TO J FOR 230V OPERATION CONNECT JUMPER FROM 4 TO SP
5. BEFORE ADDING AN 800 OHM-10 WATT RESISTOR CHECK TELETYPEWRITER PANEL TT-23( )/SG FOR INSTALLATION OF THIS RESISTOR. ON URC-32 SERIES SERIAL NUMBER 660 AND FOLLOWING THE 800 OHM RESISTOR IS PUT IN THE J-1007/U INTERCONNECTING BOX BY THE MANUFACTURER

Figure 5-92. Radio Set AN/URC-32( ), External Connections to Remote Control Units


RADIO SET
AN/URC-32 SERIES
INTERCONNECTING BOX J-1007/U
TBM
TUNER BYPASS
6
7
TBJ
TUNE-OPERATE INTERLOCK (SEE NOTE)
10
GROUND
16
TBH
115V, 60 CPS COMMON
115V, 60 CPS
4-OHM SPEAKER
SPARE
SPARE
SPARE
PA TUNE INTERLOCK
PA TUNE INTERLOCK
115 VAC OUT
+28V UNFILTERED
KEY LINE
KEYED 115V AC
TRANSMIT INTERLOCK NO.1
TRANSMIT INTERLOCK NO. 2
GROUND
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
CONNECTOR SUPPLIED WITH C-1360( )/SRT. CABLE MUST BE SUPPLIED BY INSTALLING ACTIVITY TO SUIT INSTALLATION.
P205
J205
COUPLER CONTROL
C-1360( )/SRT
(PART OF ANTENNA TUNING GROUP AN/BRA-3
L
G
E
D
C
F
M
N
P
B
MSCA-10 (8)
J251
P251
ANTENNA NETWORK
CU-737/URC
J8
RG-8/U
J2
RCVR
RCVR INPUT PROTECTOR
ANT
J1
UG-88C/U
UG-88C/U
J1
J3
AMPLIFIER, RADIO FREQUENCY AM-2061/URT
TRANSMIT RF OUT
J2
UG-210/U
UG-594/U
J2
UG-88C/U
J11
CONVERTER-OSCILLATOR CV-731/URC
RECEIVE RF IN
CONNECTORS AND CABLES SUPPLIED WITH AN/URC-32
DUMMY LOAD ELECTRICAL DA-218/U
J1
UG-210/U
UG-594/U
J10
CONNECTORS AND CABLES SUPPLIED WITH AN/URC-32

NOTE
THIS INSTALLATION DIAGRAM IS APPLICABLE ONLY TO EQUIPMENTS LATER THAN SN 821, NObsr 81220 REMOVE JUMPERS FROM TBJ-10 TO TBH-9, AND FROM TBH-15 TO TBH-16 ALSO REMOVE THE 680 OHM RESISTOR FROM TBG-5 AND TBG-6

Figure 5-93. Radio Set AN/URC-32( ), External Connections to Antenna Control C-1360( )/SRT (Part of AN/BRA-3) and Coupler Monitor CU-737/URC


LIMITED RANGE ANT.
35' WHIP OR LONG-WIRE ANT.
ANT. MULTICOUPLER
CU-714/SRA-22 ANT. COUPLER
J8 RF
J7 CONTROL
CU-737/URC MOUNTED ON TOP OR NEAR AN/URC-32
CU-737/URC ANT. TUNER
J3 RF OUT
RG-10/U
J6 RF IN
RG-8/U
RG-10/U
C-2698/SRA-22 (COUPLER CONTROL)
J3 RF OUT
RG-8/U
J1 DUMMY ANT.
J4 RCVR ANT.
RG-58/U SEE NOTE 5
PATCH PANEL SEE NOTE 2
RG-8/U
J2 RF IN
J5 CONTROL
CONTROL CABLE MSCA-24
J2 TRANSMIT RF OUT
RG-8/U
AM-2061/URT RADIO FREQUENCY AMPLIFIER
J2 RCVR
RCVR INPUT PROTECTOR
J1 ANT.
RG-58/U RCVR ANT. SEE NOTE 5
J11 RCVR RF IN
RG-58/U
CV-731/URC CONVERTER-OSCILLATOR
J1
DUMMY ANT. DA-218/U
AN/URC-32 SERIES

NOTES:

1. CU-737/URC USED FOR TRANSMITTING FUNCTION ONLY. REMOVE ANTENNA RELAY K1 AND ASSOCIATED WIRING. REMOVE DUMMY LOAD SWITCH BOX AND SWITCH (J9, J10, J11). FABRICATE RG-8/U CABLE TO CONNECT J4 DIRECTLY TO J5. REMOVE ANTENNA SELECTOR SWITCH SHAFT EXTENSION (S3) AND BLANK OFF FRONT PANEL HOLE AND SWITCH POSITION INDICATORS. CONNECT RF INPUT CABLE FROM PATCH PANEL TO J6. TO USE THE SPEAKER WITH THE RECEIVER, CONNECT PINS 3 AND 4 OF J8 TO PINS 3 AND 4 OF AN/URC-32 JUNCTION BOX TERMINAL STRIP "H".
2. PATCH PANEL TO BE DESIGNED AND FABRICATED BY INSTALLING ACTIVITY.
3. WHEN THE MULTICOUPLER CONNECTION IS USED, TWO WATTMETER INDICATIONS ARE EVIDENT, ONE IN THE CU-737/URC AND ONE IN THE C-2698/SRA-22. ONLY ONE METER NEED BE USED.
4. C-2698/SRA-22 CONTROLS ARE USED ONLY WHEN CU-714/SRA-22 IS USED.
5. J4 ON C-2698/SRA-22 MAY BE CABLED (OR ROUTED THROUGH A PATCH PANEL) TO J1 ON RECEIVER INPUT PROTECTOR FOR RECEIVING ON SAME ANTENNA AS TRANSMITTING. ALTERNATELY, J1 MAY BE CONNECTED TO ANY OTHER RECEIVING ANTENNA.

Figure 5-95. External Connections and Modifications for Alternate Use of Radio Set AN/URC-32( ) with Coupler Monitor CU-737/URC and Multicoupler

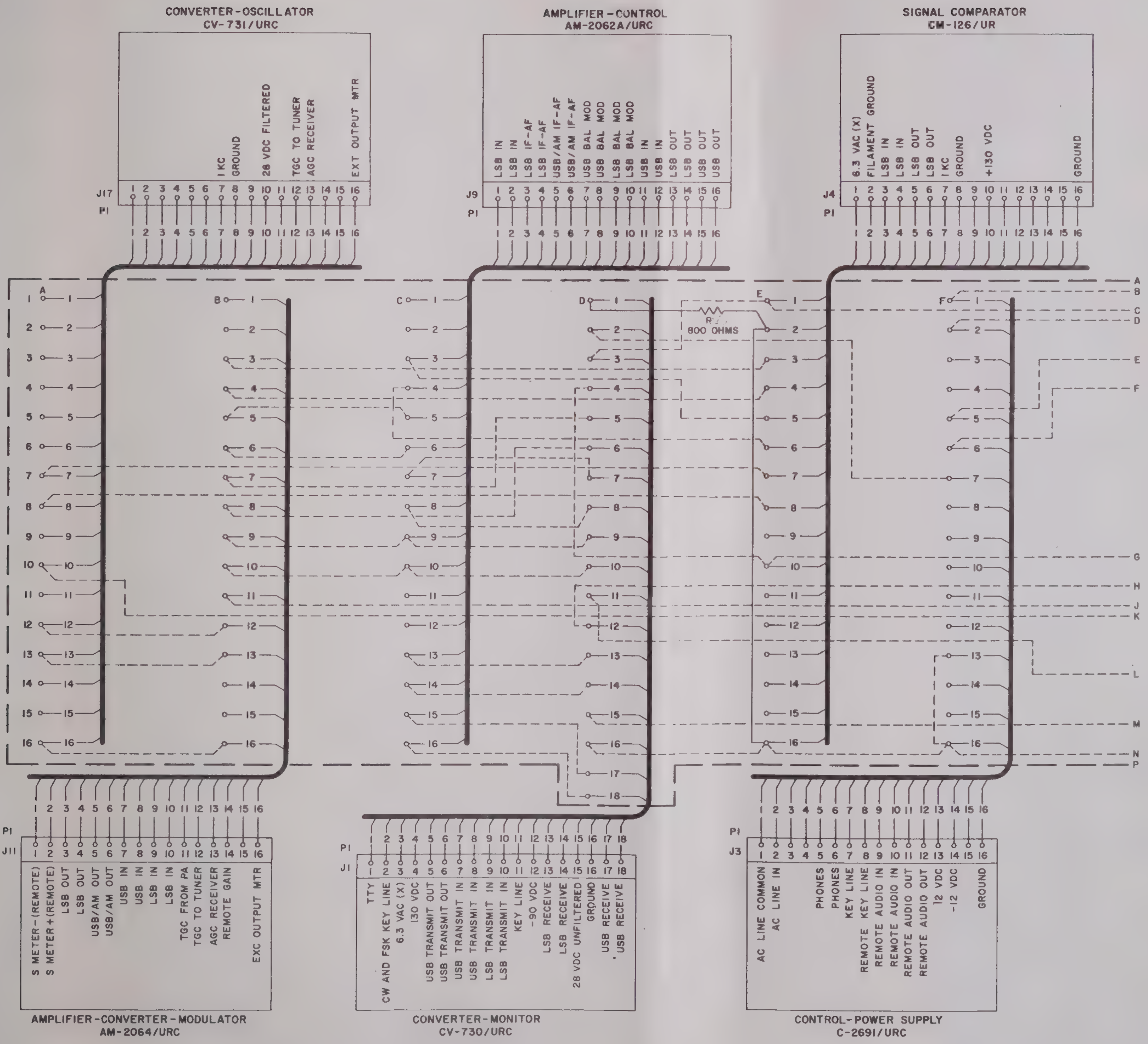
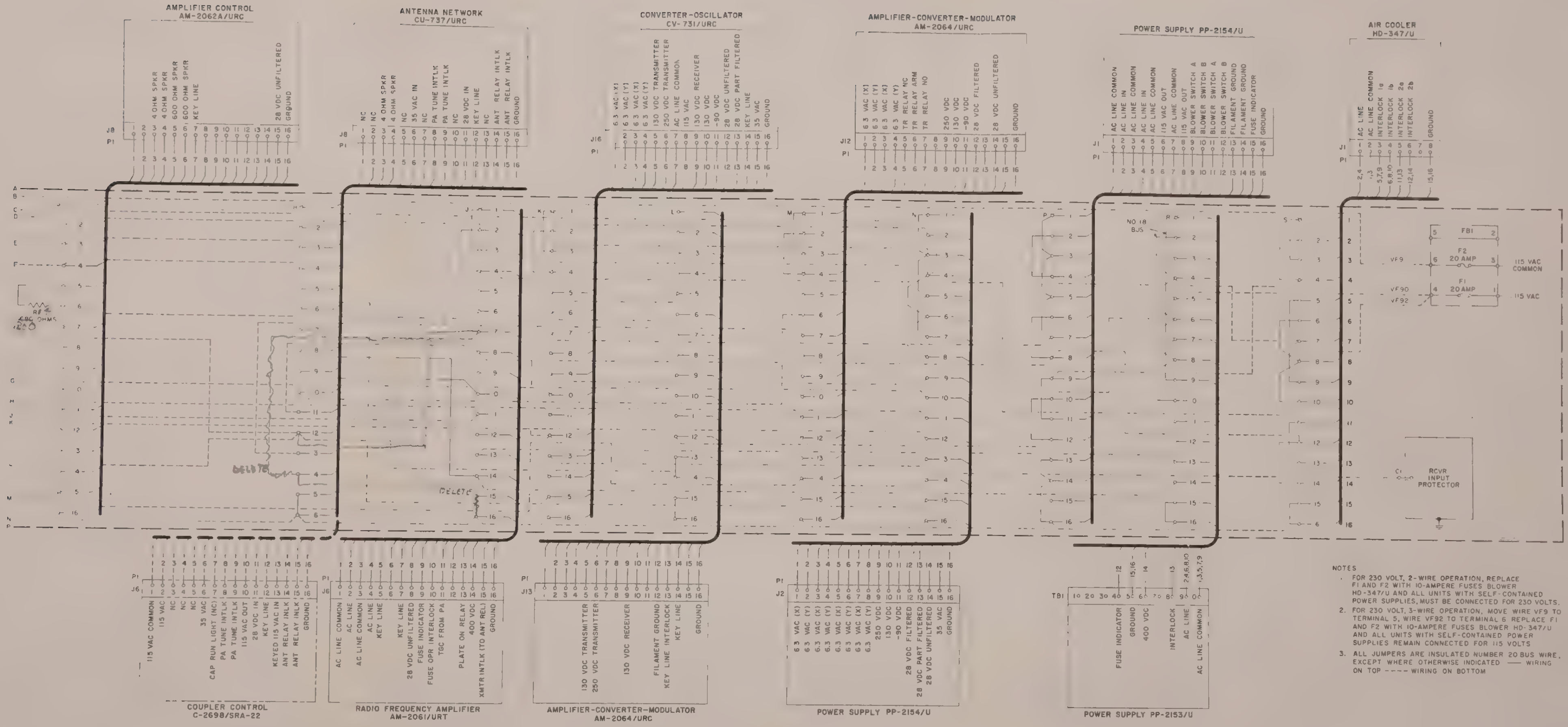

CONVERTER-OSCILLATOR
CV-731/URC
1 KC
GROUND
28 VDC FILTERED
TGC TO TUNER
AGC RECEIVER
EXT OUTPUT MTR
J17
P1
AMPLIFIER-CONTROL
AM-2062A/URC
LSB IN
LSB IN
LSB IF-AF
LSB IF-AF
USB/AM IF-AF
USB/AM IF-AF
USB BAL MOD
USB BAL MOD
LSB BAL MOD
LSB BAL MOD
USB IN
USB IN
LSB OUT
LSB OUT
USB OUT
USB OUT
J9
P1
SIGNAL COMPARATOR
CM-126/UR
6.3 VAC (X)
FILAMENT GROUND
LSB IN
LSB IN
LSB OUT
LSB OUT
1 KC
GROUND
+130 VDC
GROUND
J4
P1
A
B
C
D
E
F
R1
800 OHMS
G
H
J
K
L
M
N
P
AMPLIFIER-CONVERTER-MODULATOR
AM-2064/URC
J11
P1
S METER-(REMOTE)
S METER+(REMOTE)
LSB OUT
LSB OUT
USB/AM OUT
USB/AM OUT
USB IN
USB IN
LSB IN
LSB IN
TGC FROM PA
TGC TO TUNER
AGC RECEIVER
REMOTE GAIN
EXC OUTPUT MTR
CONVERTER-MONITOR
CV-730/URC
J1
P1
TTY
CW AND FSK KEY LINE
6.3 VAC (X)
130 VDC
USB TRANSMIT OUT
USB TRANSMIT OUT
USB TRANSMIT IN
USB TRANSMIT IN
LSB TRANSMIT IN
LSB TRANSMIT IN
KEY LINE
-90 VDC
LSB RECEIVE
LSB RECEIVE
28 VDC UNFILTERED
GROUND
USB RECEIVE
USB RECEIVE
CONTROL-POWER SUPPLY
C-2691/URC
J3
P1
AC LINE COMMON
AC LINE IN
PHONES
PHONES
KEY LINE
REMOTE KEY LINE
REMOTE AUDIO IN
REMOTE AUDIO IN
REMOTE AUDIO OUT
REMOTE AUDIO OUT
12 VDC
-12 VDC
GROUND

Figure 5-96. Interconnecting Box J-1007/U, Interconnecting Wiring Diagram
(Sheet 1 of 2)


AMPLIFIER CONTROL
AM-2062A/URC
J8
P1
4 OHM SPKR
4 OHM SPKR
600 OHM SPKR
600 OHM SPKR
KEY LINE
28 VDC UNFILTERED
GROUND
ANTENNA NETWORK
CU-737/URC
NC
NC
4 OHM SPKR
4 OHM SPKR
NC
35 VAC IN
NC
PA TUNE INTLK
PA TUNE INTLK
NC
28 VDC IN
KEY LINE
NC
ANT RELAY INTLK
ANT RELAY INTLK
GROUND
CONVERTER-OSCILLATOR
CV-731/URC
J16
6 3 VAC (X)
6 3 VAC (Y)
6 3 VAC (X)
6 3 VAC (Y)
130 VDC TRANSMITTER
250 VDC TRANSMITTER
AC LINE COMMON
115 VAC
130 VDC RECEIVER
130 VDC
-90 VDC
28 VDC UNFILTERED
28 VDC PART FILTERED
KEY LINE
35 VAC
GROUND
AMPLIFIER-CONVERTER-MODULATOR
AM-2064/URC
J12
6 3 VAC (X)
6 3 VAC (Y)
6 3 VAC (X)
6 3 VAC (Y)
TR RELAY NC
TR RELAY ARM
TR RELAY NO
250 VDC
130 VDC
-90 VDC
28 VDC FILTERED
28 VDC UNFILTERED
GROUND
POWER SUPPLY PP-2154/U
J1
AC LINE COMMON
AC LINE IN
AC LINE COMMON
AC LINE IN
AC LINE COMMON
115 VAC OUT
AC LINE COMMON
115 VAC OUT
BLOWER SWITCH A
BLOWER SWITCH B
BLOWER SWITCH A
BLOWER SWITCH B
FILAMENT GROUND
FILAMENT GROUND
FUSE INDICATOR
GROUND
AIR COOLER
HD-347/U
AC LINE
AC LINE COMMON
INTERLOCK 1a
INTERLOCK 1b
INTERLOCK 2a
INTERLOCK 2b
GROUND
2,4
1,3
5,7,9
6,8,10
11,13
12,14
15,16
A
B
C
D
E
F
G
H
J
K
L
M
N
P
R
S
R8
DELETE
DELETE
NO 18
BUS
FB1
F2
20 AMP
F1
20 AMP
VF9
VF90
VF92
115 VAC
COMMON
115 VAC
C1
RCVR
INPUT
PROTECTOR
COUPLER CONTROL
C-2698/SRA-22
J6
115 VAC COMMON
115 VAC
NC
NC
NC
35 VAC
CAP RUN LIGHT (NC)
PA TUNE INTLK
PA TUNE INTLK
115 VAC OUT
28 VDC IN
KEY LINE
KEYED 115 VAC IN
ANT RELAY INLK
ANT RELAY INLK
GROUND
RADIO FREQUENCY AMPLIFIER
AM-2061/URT
AC LINE COMMON
AC LINE
AC LINE COMMON
AC LINE
KEY LINE
KEY LINE
28 VDC UNFILTERED
FUSE INDICATOR
FUSE OPR INTERLOCK
TGC FROM PA
PLATE ON RELAY
400 VDC
XMTR INTLK (TO ANT REL)
GROUND
AMPLIFIER-CONVERTER-MODULATOR
AM-2064/URC
J13
130 VDC TRANSMITTER
250 VDC TRANSMITTER
130 VDC RECEIVER
FILAMENT GROUND
KEY LINE INTERLOCK
KEY LINE
GROUND
POWER SUPPLY PP-2154/U
J2
6 3 VAC (X)
6 3 VAC (Y)
6.3 VAC (X)
6.3 VAC (Y)
6.3 VAC (X)
6 3 VAC (Y)
6 3 VAC (X)
6.3 VAC (Y)
250 VDC
130 VDC
-90 VDC
28 VDC FILTERED
28 VDC PART FILTERED
28 VDC UNFILTERED
35 VAC
GROUND
TB1
12
15,16
14
13
2,4,6,8,10
1,3,5,7,9
FUSE INDICATOR
GROUND
400 VDC
INTERLOCK
AC LINE
AC LINE COMMON
POWER SUPPLY PP-2153/U

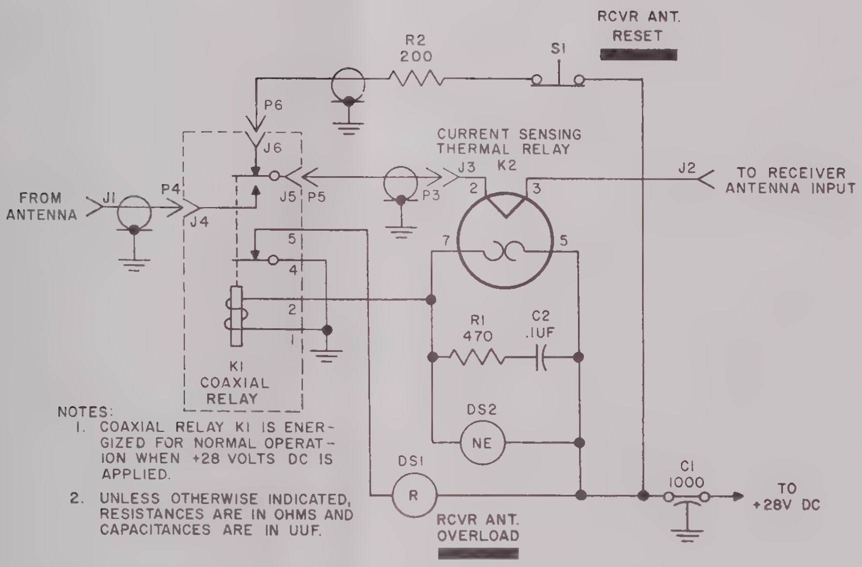
NOTES

FOR 230 VOLT, 2-WIRE OPERATION, REPLACE F1 AND F2 WITH 10-AMPERE FUSES BLOWER HD-347/U AND ALL UNITS WITH SELF-CONTAINED POWER SUPPLIES, MUST BE CONNECTED FOR 230 VOLTS.

2. FOR 230 VOLT, 3-WIRE OPERATION, MOVE WIRE VF9 TO TERMINAL 5, WIRE VF92 TO TERMINAL 6 REPLACE F1 AND F2 WITH 10-AMPERE FUSES BLOWER HD-347/U AND ALL UNITS WITH SELF-CONTAINED POWER SUPPLIES REMAIN CONNECTED FOR 115 VOLTS

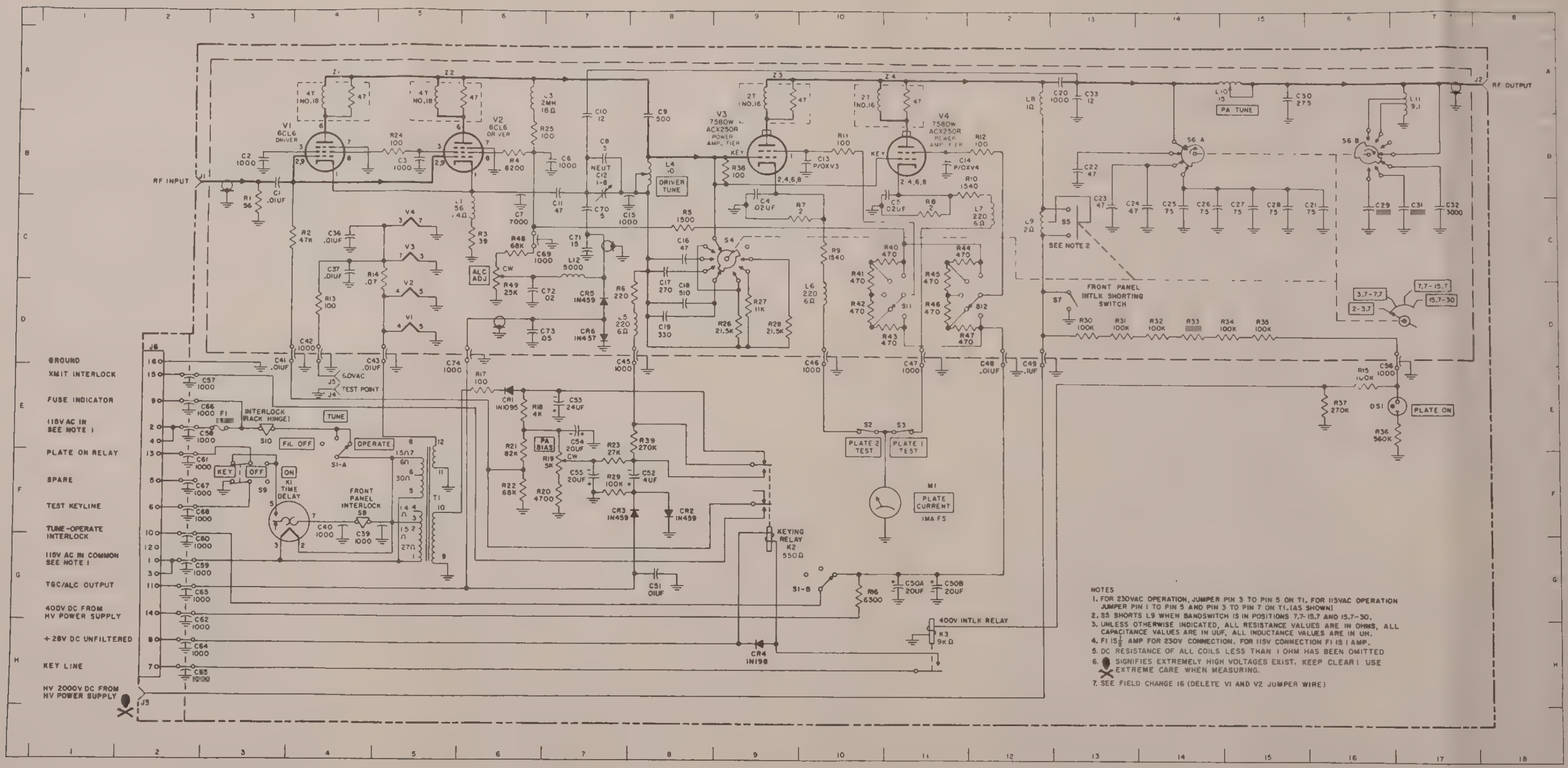
3. ALL JUMPERS ARE INSULATED NUMBER 20 BUS WIRE, EXCEPT WHERE OTHERWISE INDICATED —— WIRING ON TOP ---- WIRING ON BOTTOM

Figure 5-96. Interconnecting Box J-1007/U, Interconnecting Wiring Diagram
(Sheet 2 of 2)


RCVR ANT.
RESET
R2
200
S1
P6
J6
CURRENT SENSING
THERMAL RELAY
J3
K2
J2
TO RECEIVER
ANTENNA INPUT
FROM
ANTENNA
J1
P4
J4
J5
P5
P3
2
3
7
5
5
4
2
1
R1
470
C2
.1UF
K1
COAXIAL
RELAY
DS2
NE
DS1
R
C1
1000
TO
+28V DC
RCVR ANT.
OVERLOAD

NOTES:
1. COAXIAL RELAY K1 IS ENERGIZED FOR NORMAL OPERATION WHEN +28 VOLTS DC IS APPLIED.
2. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS AND CAPACITANCES ARE IN UUF.

Figure 5-97. Interconnecting Box J-1007/U, Thermal Relay Input Protector, Schematic Diagram


RF INPUT
RF OUTPUT
J1
J2
J3
J4
J5
J6
V1 6CL6 DRIVER
V2 6CL6 DRIVER
V3 7580W ACX250R POWER AMPLIFIER
V4 7580W ACX250R POWER AMPLIFIER
Z1
Z2
Z3
Z4
DRIVER TUNE
PA TUNE
ALC ADJ
PA BIAS
NEUT C12
S4
S5
SEE NOTE 2
S6 A
S6 B
S7
FRONT PANEL INTLK SHORTING SWITCH
S11
S12
S2
S3
PLATE 2 TEST
PLATE 1 TEST
M1 PLATE CURRENT 1MA FS
DS1
PLATE ON
KEYING RELAY K2 550Ω
400V INTLK RELAY K3 9KΩ
K1 TIME DELAY
FRONT PANEL INTERLOCK S8
INTERLOCK (RACK HINGE)
TUNE
OPERATE
FIL OFF
KEY
OFF
ON
S1-A
S1-B
S9
S10
T1
6.0VAC
TEST POINT
GROUND
XMIT INTERLOCK
FUSE INDICATOR
115V AC IN SEE NOTE 1
PLATE ON RELAY
SPARE
TEST KEYLINE
TUNE-OPERATE INTERLOCK
115V AC IN COMMON SEE NOTE 1
TGC/ALC OUTPUT
400V DC FROM HV POWER SUPPLY
+28V DC UNFILTERED
KEY LINE
HV 2000V DC FROM HV POWER SUPPLY
3.7-7.7
2-3.7
7.7-15.7
15.7-30
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
A
B
C
D
E
F
G
H

NOTES

1. FOR 230VAC OPERATION, JUMPER PIN 3 TO PIN 5 ON T1. FOR 115VAC OPERATION JUMPER PIN 1 TO PIN 5 AND PIN 3 TO PIN 7 ON T1. (AS SHOWN)
2. S5 SHORTS L9 WHEN BANDSWITCH IS IN POSITIONS 7.7-15.7 AND 15.7-30.
3. UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES ARE IN UUF, ALL INDUCTANCE VALUES ARE IN UH.
4. F1 IS ½ AMP FOR 230V CONNECTION. FOR 115V CONNECTION F1 IS 1 AMP.
5. DC RESISTANCE OF ALL COILS LESS THAN 1 OHM HAS BEEN OMITTED
6. ☠ SIGNIFIES EXTREMELY HIGH VOLTAGES EXIST. KEEP CLEAR! USE EXTREME CARE WHEN MEASURING.
7. SEE FIELD CHANGE 16 (DELETE V1 AND V2 JUMPER WIRE)

Figure 5-99. Radio Frequency Amplifier AM-2061/URT, MCN No. 1834 and Above, Schematic Diagram

PART LOCATION INDEX

REF DESIG	LOC	REF DESIG	LOC	REF DESIG	LOC
C1	3-B	C59	2-G	T1	5-F
C2	3-B	C60	2-G	V1	4-B
C3	5-B	C61	2-F	V2	6-B
C4	9-B	C62	2-G	V3	9-B
C5	11-B	C63	2-H	V4	11-B
C6	7-B	C64	2-H	Z1	4-A
C7	6-B	C65	2-G	Z2	5-A
C8	7-B	C66	2-E	Z3	9-A
C9	8-B	C67	2-F	Z4	11-A
C10	7-B	C68	2-F	R1	3-C
C11	7-B	C69	6-C	R2	4-C
C12	7-B	C70	7-C	R3	6-C
C13	10-B	C71	7-C	R4	6-B
C14	11-B	C72	6-D	R5	8-C
C15	7-C	C73	6-D	R6	8-D
C16	8-C	C74	6-D	R7	9-C
C17	8-C	CR1	6-E	R8	11-C
C18	8-D	CR2	8-F	R9	10-C
C19	8-D	CR3	8-F	R10	12-B
C20	13-A	CR4	9-H	R11	10-B
C21	16-C	CR5	7-D	R12	12-B
C22	13-B	CR6	7-D	R13	4-D
C23	13-C	DS1	17-E	R14	5-C
C24	14-C	F1	3-E	R15	16-E
C25	14-C	J1	2-B	R16	10-G
C26	14-C	J2	18-A	R17	6-E
C27	15-C	J3	2-H	R18	6-E
C28	15-C	J4	4-E	R19	7-F
C29	16-C	J5	4-E	R20	7-F
C30	15-A	K1	3-F	R21	6-E
C31	17-C	K2	9-G	R22	6-F
C32	17-C	K3	11-H	R23	7-F
C33	13-A	L1	6-C	R24	5-B
C34		L2		R25	6-B
C35		L3	6-A	R26	9-D
C36	4-C	L4	8-B	R27	9-D
C37	4-C	L5	7-D	R28	9-D
C38		L6	10-D	R29	7-F
C39	5-F	L7	12-C	R30	13-D
C40	4-F	L8	12-A	R31	13-D
C41	4-D	L9	12-C	R32	14-D
C42	4-D	L10	15-A	R33	14-D
C43	5-D	L11	17-A	R34	15-D
C44		L12	7-C	R35	15-D
C45	8-D	M1	11-F	R36	17-E
C46	10-D	S1A	4-E	R37	16-E
C47	11-D	S1B	10-G	R38	9-B
C48	12-D	S2	10-E	R39	8-E
C49	12-D	S3	11-E	R40	11-C
C50-A -B	11-G	S4	9-C	R41	10-C
		S5	13-C	R42	10-D
C51	8-G	S6A	14-B	R43	11-D
C52	8-F	S6B	16-B	R44	11-C
C53	7-E	S7	13-D	R45	11-C
C54	7-E	S8	4-F	R46	11-D
C55	7-F	S9	3-F	R47	11-D
C56	17-D	S10	3-E	R48	6-C
C57	2-E	S11	11-D	R49	6-D
C58	2-E	S12	12-D		

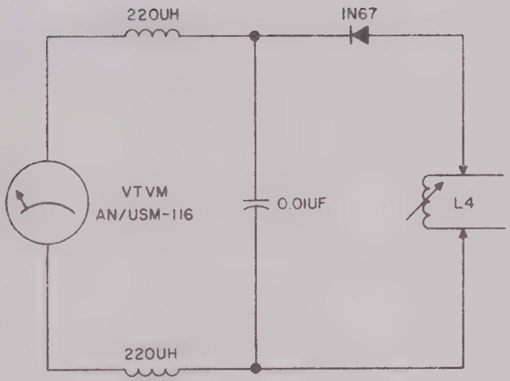
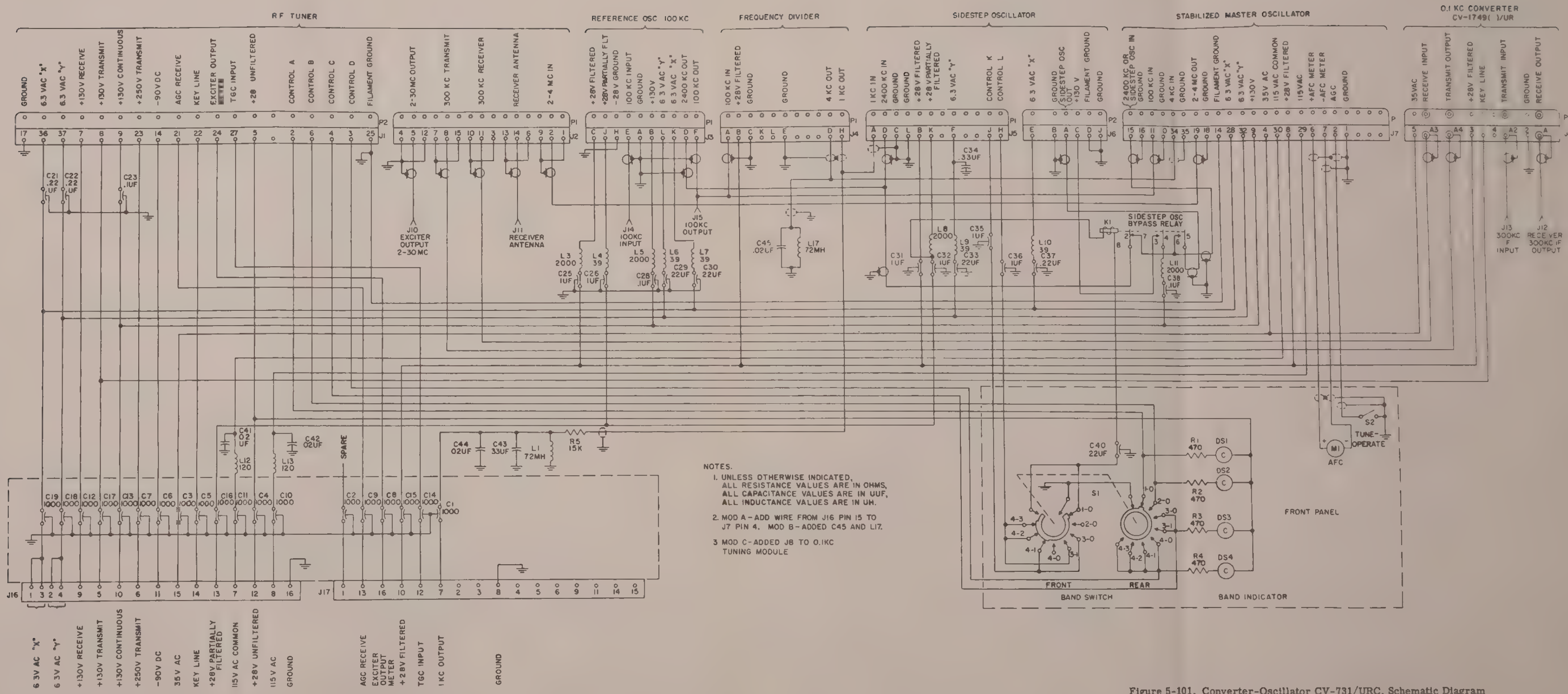

220UH
IN67
VTVM
AN/USM-116
0.01UF
L4
220UH

Figure 5-100. Radio Frequency Amplifier AM-2061/URT, Alignment Test Setup


RF TUNER
GROUND
6.3 VAC "X"
6.3 VAC "Y"
+130V RECEIVE
+130V TRANSMIT
+130V CONTINUOUS
+250V TRANSMIT
-90VDC
AGC RECEIVE
KEY LINE
EXCITER OUTPUT
TGC INPUT
+28 UNFILTERED
CONTROL A
CONTROL B
CONTROL C
CONTROL D
FILAMENT GROUND
2-30MC OUTPUT
300 KC TRANSMIT
300 KC RECEIVER
RECEIVER ANTENNA
2-4 MC IN
P2
J1
P1
J2
REFERENCE OSC 100KC
+28V FILTERED
+28V PARTIALLY FLT
-28V GROUND
100 KC INPUT
GROUND
+130V
6 3 VAC "Y"
6 3 VAC "X"
2400 KC OUT
100 KC OUT
J3
FREQUENCY DIVIDER
100 KC IN
+28V FILTERED
GROUND
GROUND
4 KC OUT
1 KC OUT
J4
SIDESTEP OSCILLATOR
1 KC IN
2400 KC IN
GROUND
GROUND
+28 V FILTERED
+28 V PARTIALLY FILTERED
6.3 VAC "Y"
CONTROL K
CONTROL L
J5
6 3 VAC "X"
GROUND
SIDESTEP OSC OUT
+130 V
FILAMENT GROUND
GROUND
J6
STABILIZED MASTER OSCILLATOR
2400 KC OR SIDESTEP OSC IN
GROUND
100 KC IN
GROUND
4 KC IN
GROUND
2-4 MC OUT
GROUND
FILAMENT GROUND
6 3 VAC "X"
6 3 VAC "Y"
+130V
35V AC
115 VAC COMMON
+28V FILTERED
115VAC
+AFC METER
-AFC METER
AGC
GROUND
P
J7
0.1 KC CONVERTER
CV-1749( )/UR
35VAC
RECEIVE INPUT
TRANSMIT OUTPUT
+28V FILTERED
KEY LINE
TRANSMIT INPUT
GROUND
RECEIVE OUTPUT
P1
J8
C21 .22 UF
C22 .22 UF
C23 .1UF
J10 EXCITER OUTPUT 2-30MC
J11 RECEIVER ANTENNA
J14 100KC INPUT
J15 100KC OUTPUT
L3 2000
L4 39
C25 1UF
C26 1UF
L5 2000
C28 .1UF
L6 39
C29 22UF
L7 39
C30 22UF
C45 .02UF
L17 72MH
C34 .33UF
C31 1UF
L8 2000
C32 1UF
L9 39
C33 22UF
C35 1UF
C36 1UF
L10 39
C37 22UF
K1
SIDESTEP OSC BYPASS RELAY
L11 2000
C38 .1UF
J13 300KC F INPUT
J12 RECEIVER 300KC IF OUTPUT
C41 .02 UF
L12 120
C42 .02UF
L13 120
SPARE
C44 .02UF
C43 .33UF
L1 72MH
R5 15K
C19 1000
C18 1000
C12 1000
C17 1000
C13 1000
C7 1000
C6 1000
C3 1000
C5 1000
C16 1000
C11 1000
C4 1000
C10 1000
C2 1000
C9 1000
C8 1000
C15 1000
C14 1000
C1 1000
J16
J17
6 3V AC "X"
6 3V AC "Y"
+130V RECEIVE
+130V TRANSMIT
+130V CONTINUOUS
+250V TRANSMIT
-90V DC
35V AC
KEY LINE
+28V PARTIALLY FILTERED
115V AC COMMON
+28V UNFILTERED
115 V AC
GROUND
AGC RECEIVE
EXCITER OUTPUT METER
+28V FILTERED
TGC INPUT
1 KC OUTPUT
GROUND
C40 22UF
S1
FRONT
REAR
BAND SWITCH
R1 470
R2 470
R3 470
R4 470
DS1
DS2
DS3
DS4
BAND INDICATOR
FRONT PANEL
S2
TUNE-OPERATE
M1
AFC

NOTES.

1. UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES ARE IN UUF, ALL INDUCTANCE VALUES ARE IN UH.

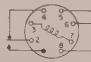
2. MOD A - ADD WIRE FROM J16 PIN 15 TO J7 PIN 4. MOD B - ADDED C45 AND L17.

3 MOD C - ADDED J8 TO 0.1KC TUNING MODULE

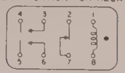
Figure 5-101. Converter-Oscillator CV-731/URC, Schematic Diagram (0.1-Kc Tuning Module Included)

NOTES-

1. UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES SHOWN IN OHMS, ALL CAPACITANCE VALUES SHOWN IN MICROMICROFARADS, AND ALL INDUCTANCE VALUES SHOWN IN MICROHENRYS.
2. DC RESISTANCE OF ALL COILS LESS THAN ONE OHM HAS BEEN OMITTED.
3. PIN IDENTIFICATION FOR RELAY KI.



4. PIN IDENTIFICATION FOR RELAY K2



5. ALL SWITCHES SHOWN IN BAND I POSITION ONLY, AND SIGNAL FLOW SHOWN ONLY FOR BAND I
6. FOR DESTINATION OF INPUTS AND OUTPUTS OF PI AND P2, SEE FREQUENCY GENERATOR 786E-1 CHASSIS SCHEMATIC DIAGRAM.
7. REFERENCE DESIGNATIONS ARE ABBREVIATED: PREFIX DESIGNATIONS WITH UNIT NUMBER AND SUBASSEMBLY DESIGNATION.
8. ALL VOLTAGE AND RESISTANCE MEASUREMENTS TAKEN WITH VTVM TO GROUND. RESISTANCE MEASUREMENTS TAKEN WITH MODULE REMOVED FROM CHASSIS. ALL VOLTAGE MEASUREMENTS TAKEN WITH UNIT PLUGGED INTO CHASSIS OR CONNECTED WITH PENDANT CABLES, WITH THE UNIT SET FOR 11.7MC OPERATION WITH A 3MC OSCILLATOR INJECTION SIGNAL. T AND R IN TABLE INDICATE TRANSMIT AND RECEIVE MODES OF OPERATION, RESPECTIVELY. NC IN TABLE MEANS NOT CONNECTED.

REF DES		PIN NUMBERS								
		1	2	3	4	5	6	7	8	9
V1	V	T -1.8V R 130V	T -90V R 0	4.2V	0	0	T 130V R -0.9V	0	4.2V	6.3VAC
	R	INF	30K	1K	INF	INF	INF	9	1K	INF
V2	V	T 0 R 0.65V	0	0	6.3VAC	T 110V R -0.9V	T 110V R -0.9V	T 1.5V R 0	NC	
	R	INF	0	INF	INF	INF	INF	130	NC	
V3	V	T -1.8V R 130V	T -90V R 0	4.2V	0	0	T 135V R-0.9V	0	4.2V	6.3VAC
	R	INF	28K	1K	INF	INF	INF	INF	1K	INF
V4	V	T 0 R -0.6V	0	0	6.3V AC	T 110V R-0.9V	T 110V R-0.9V	T 0 R 5.6V	NC	
	R	470K	0	INF	INF	INF	INF	68	NC	
V5	V	T 0 R-0.6V	0	0	6.3V AC	T 130V R-0.9V	T 130V R-0.9V	0	NC	
	R	470K	0	INF	INF	INF	INF	1K	NC	
V6	V	T 2.75V R 0	T 0 R-0.5V	T 155V R-1.6V	0	6.3V AC	T 250V R-1.6V	0	T 155V R-1.6V	T 0 R-0.5V
	R	68	100K	INF	INF	INF	INF	0	INF	100K
V7	V	T -90V R -0.5V	0	0	6.3V AC	T -1.8V R 110V	T -1.8V R 110V	T 0 R 0.9V	NC	
	R	3.8MEGO	0	INF	INF	INF	INF	INF	NC	
V8	V	T -90V R -0.3V	T 0 R 0.6V	0	6.3V AC	T -1.8V R 100V	T -1.8V R 100V	T 0 R 0.6V	NC	
	R	3.8MEGO	INF	INF	INF	INF	INF	INF	NC	
V9	V	-35V	0	0	6.3V AC	110V	90V	0	NC	
	R	1 MEGO	0	INF	INF	INF	INF	0	NC	
V10	V	0	0	0	6.3V AC	110V	110V	2.3V	NC	
	R	470K	0	INF	INF	INF	INF	270	NC	

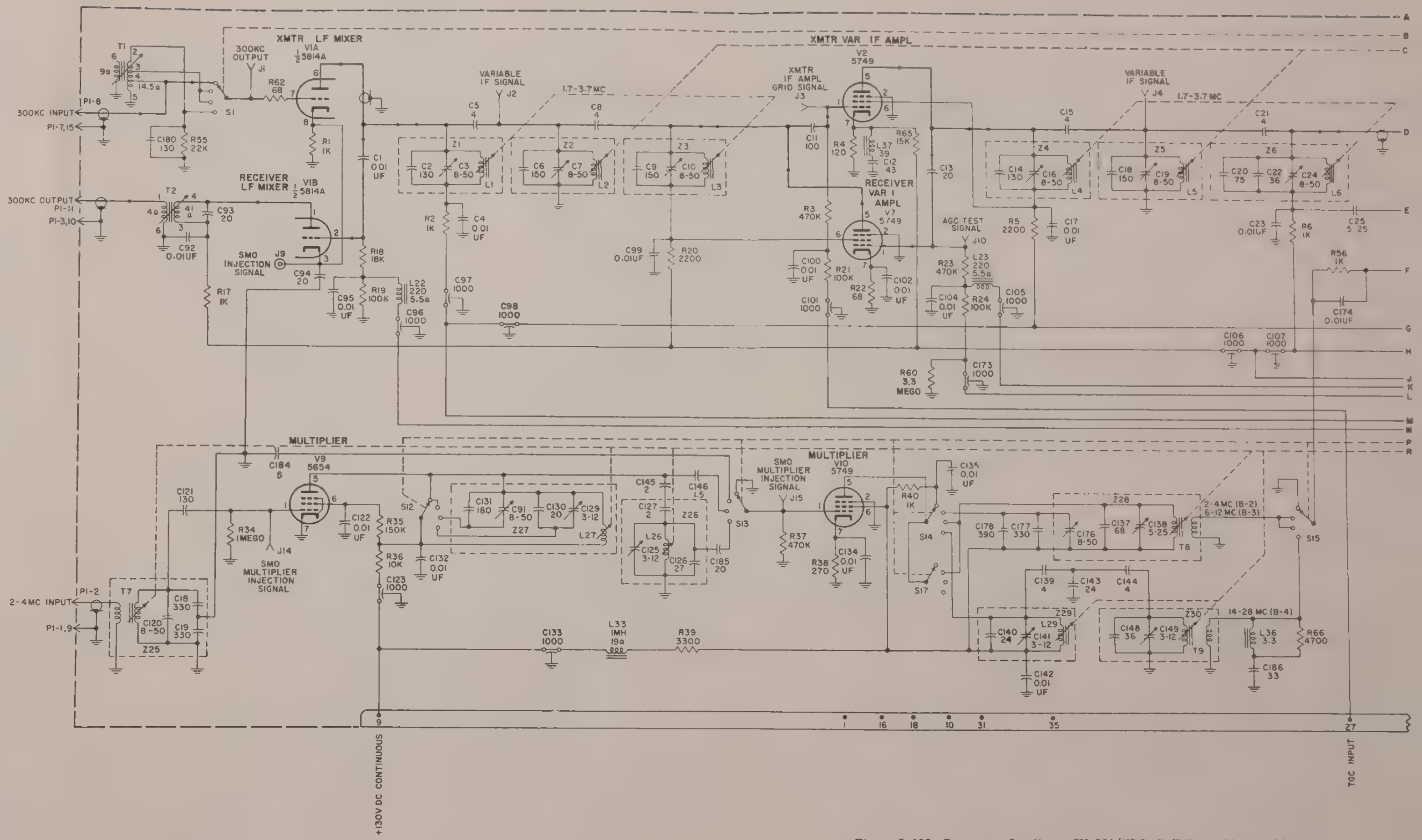
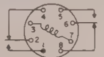

XMTR LF MIXER
V1A ½ 5814A
300KC OUTPUT
J1
R62 68
S1
T1
P1-8
300KC INPUT
P1-7,15
C180 130
R55 22K
R1 1K
C1 0.01 UF
RECEIVER LF MIXER
V1B ½ 5814A
300KC OUTPUT
P1-11
P1-3,10
T2
C93 20
C92 0.01UF
SMO INJECTION SIGNAL
J9
C94 20
R17 1K
R18 18K
R19 100K
C95 0.01 UF
L22 220 5.5a
C96 1000
VARIABLE IF SIGNAL
J2
1.7-3.7MC
C5 4
C8 4
Z1
C2 130
C3 8-50
L1
Z2
C6 150
C7 8-50
L2
Z3
C9 150
C10 8-50
L3
R2 1K
C4 0.01 UF
C97 1000
C98 1000
C99 0.01UF
R20 2200
XMTR VAR IF AMPL
V2 5749
XMTR IF AMPL GRID SIGNAL
J3
C11 100
R4 120
L37 39
C12 43
R65 15K
C13 20
RECEIVER VAR I AMPL
V7 5749
R3 470K
C100 0.01 UF
C101 1000
R21 100K
R22 68
C102 0.01 UF
AGC TEST SIGNAL
J10
R23 470K
L23 220 5.5a
C104 0.01 UF
R24 100K
C105 1000
C173 1000
R60 3.3 MEGO
R5 2200
C17 0.01 UF
VARIABLE IF SIGNAL
J4
1.7-3.7MC
C15 4
C21 4
Z4
C14 130
C16 8-50
L4
Z5
C18 150
C19 8-50
L5
Z6
C20 75
C22 36
C24 8-50
L6
C23 0.01UF
R6 1K
C25 5 25
R56 1K
C174 0.01UF
C106 1000
C107 1000
A
B
C
D
E
F
G
H
J
K
L
M
N
P
R
MULTIPLIER
C184 5
V9 5654
C121 130
R34 1MEGO
J14
SMO MULTIPLIER INJECTION SIGNAL
C122 0.01 UF
R35 150K
R36 10K
C123 1000
C132 0.01 UF
S12
C131 180
C91 8-50
C130 20
C129 3-12
Z27
L27
C145 2
C146 1.5
C127 2
Z26
L26
C125 3-12
C126 27
C185 20
S13
2-4MC INPUT
P1-2
P1-1,9
T7
C120 8-50
C18 330
C19 330
Z25
SMO MULTIPLIER INJECTION SIGNAL
J15
MULTIPLIER
V10 5749
R37 470K
R38 270
C134 0.01 UF
R40 1K
C135 0.01 UF
S14
S17
Z28
C178 390
C177 330
C176 8-50
C137 68
C138 5-25
T8
2-4MC (B-2)
6-12MC (B-3)
S15
C139 4
C143 24
C144 4
Z29
C140 24
C141 3-12
L29
C142 0.01 UF
Z30
C148 36
C149 3-12
T9
14-28 MC (B-4)
L36 3.3
R66 4700
C186 33
C133 1000
L33 1MH 19a
R39 3300
9
1
16
18
10
31
35
27
+130V DC CONTINUOUS
TGC INPUT

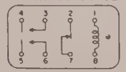
Figure 5-102. Converter-Oscillator CV-731/URC, R-F Tuner Module, Model A, Schematic Diagram (Sheet 1 of 2)

NOTES-

1. UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES SHOWN IN OHMS, ALL CAPACITANCE VALUES SHOWN IN MICROMICROFARADS, AND ALL INDUCTANCE VALUES SHOWN IN MICROHENRYS.
2. DC RESISTANCE OF ALL COILS LESS THAN ONE OHM HAS BEEN OMITTED.
3. PIN IDENTIFICATION FOR RELAY K1.



4. PIN IDENTIFICATION FOR RELAY K2.



5. ALL SWITCHES SHOWN IN BAND 1 POSITION ONLY, AND SIGNAL FLOW SHOWN ONLY FOR BAND 1.
6. FOR DESTINATION OF INPUTS AND OUTPUTS OF P1 AND P2, SEE FREQUENCY GENERATOR 786E-1 CHASSIS SCHEMATIC DIAGRAM.
7. REFERENCE DESIGNATIONS ARE ABBREVIATED: PREFIX DESIGNATIONS WITH UNIT NUMBER AND SUBASSEMBLY DESIGNATION.
8. ALL VOLTAGE AND RESISTANCE MEASUREMENTS TAKEN WITH VTVM TO GROUND. RESISTANCE MEASUREMENTS TAKEN WITH MODULE REMOVED FROM CHASSIS. ALL VOLTAGE MEASUREMENTS TAKEN WITH UNIT PLUGGED INTO CHASSIS OR CONNECTED WITH PENDANT CABLES, WITH THE UNIT SET FOR 11.7MC OPERATION WITH A 3MC OSCILLATOR INJECTION SIGNAL. T AND R IN TABLE INDICATE TRANSMIT AND RECEIVE MODES OF OPERATION, RESPECTIVELY. NC IN TABLE MEANS NOT CONNECTED.

REF DES		PIN NUMBERS								
		1	2	3	4	5	6	7	8	9
V1	V	T -1.8V R 130V	T -90V R 0	4.2V	0	0	T 130V R -0.9V	0	4.2V	6.3V AC
	R	INF	30K	1K	INF	INF	INF	9	1K	INF
V2	V	T 0 R 0.65V	0	0	6.3VAC	T 110V R -0.9V	T 110V R -0.9V	T 1.5V R 0	NC	
	R	INF	0	INF	INF	INF	INF	130	NC	
V3	V	T -1.8V R 130V	T -90V R 0	4.2V	0	0	T 135V R-0.9V	0	4.2V	6.3V AC
	R	INF	28K	1K	INF	INF	INF	INF	1K	INF
V4	V	T 0 R -0.6V	0	0	6.3V AC	T 110V R -0.9V	T 110V R -0.9V	T 0 R 5.6V	NC	
	R	470K	0	INF	INF	INF	INF	68	NC	
V5	V	T 0 R -0.6V	0	0	6.3V AC	T 130V R-0.9V	T 130V R-0.9V	0	NC	
	R	470K	0	INF	INF	INF	INF	1K	NC	
V6	V	T 2.75V R 0	T 0 R -0.5V	T 155V R -1.6V	0	6.3V AC	T 250V R -1.6V	0	T 155V R -1.6V	T 0 R -0.5V
	R	68	100K	INF	INF	INF	INF	0	INF	100K
V7	V	T -90V R -0.5V	0	0	6.3V AC	T -1.8V R 110V	T -1.8V R 110V	T 0 R 0.9V	NC	
	R	3.8MEGO	0	INF	INF	INF	INF	INF	NC	
V8	V	T -90V R -0.3V	T 0 R 0.6V	0	6.3V AC	T -1.8V R 100V	T -1.8V R 100V	T 0 R 0.6V	NC	
	R	3.8MEGO	INF	INF	INF	INF	INF	INF	NC	
V9	V	-35V	0	0	6.3V AC	110V	90V	0	NC	
	R	1 MEGO	0	INF	INF	INF	INF	0	NC	
V10	V	0	0	0	6.3V AC	110V	110V	2.3V	NC	
	R	470K	0	INF	INF	INF	INF	270	NC	

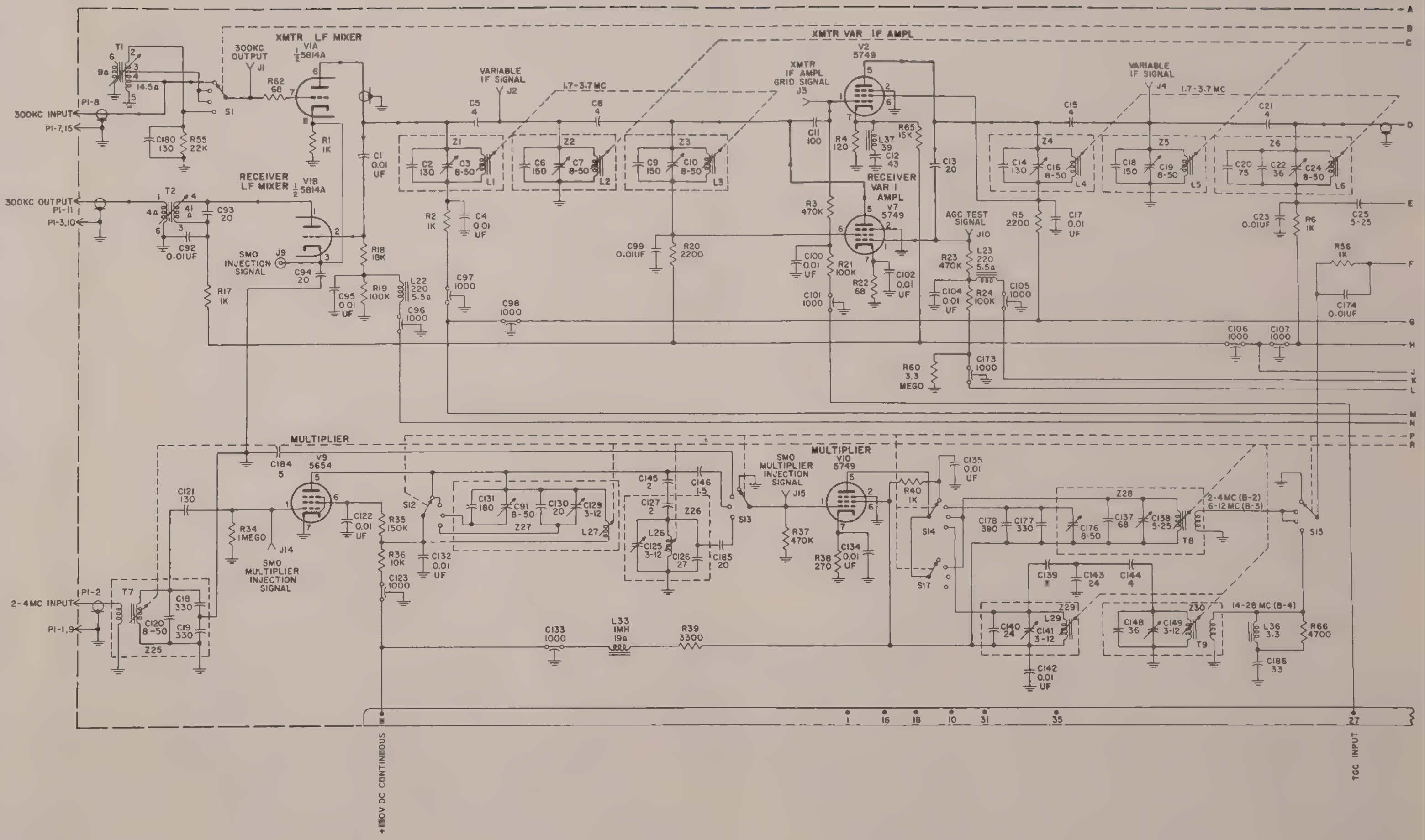

XMTR LF MIXER
V1A ½5814A
300KC OUTPUT
J1
300KC INPUT
P1-8
P1-7,15
T1
S1
C180 130
R55 22K
R62 68
R1 1K
C1 0.01 UF
300KC OUTPUT
P1-11
P1-3,10
T2
C93 20
C92 0.01UF
RECEIVER LF MIXER
V1B ½5814A
SMO INJECTION SIGNAL
J9
C94 20
R18 18K
R17 1K
C95 0.01 UF
R19 100K
L22 220 5.5a
C96 1000
VARIABLE IF SIGNAL
J2
1.7-3.7MC
C5 4
C8 4
Z1
C2 130
C3 8-50
L1
Z2
C6 150
C7 8-50
L2
Z3
C9 150
C10 8-50
L3
R2 1K
C4 0.01 UF
C97 1000
C98 1000
C99 0.01UF
R20 2200
XMTR IF AMPL GRID SIGNAL
J3
XMTR VAR IF AMPL
V2 5749
C11 100
R4 120
L37 39
C12 43
R65 15K
C13 20
RECEIVER VAR I AMPL
V7 5749
R3 470K
C100 0.01 UF
R21 100K
R22 68
C102 0.01 UF
C101 1000
AGC TEST SIGNAL
J10
R23 470K
L23 220 5.5a
C104 0.01 UF
R24 100K
C105 1000
R60 3.3 MEGO
C173 1000
VARIABLE IF SIGNAL
J4
1.7-3.7MC
C15 4
C21 4
Z4
C14 130
C16 8-50
L4
Z5
C18 150
C19 8-50
L5
Z6
C20 75
C22 36
C24 8-50
L6
R5 2200
C17 0.01 UF
C23 0.01UF
R6 1K
C25 5-25
R56 1K
C174 0.01UF
C106 1000
C107 1000
A
B
C
D
E
F
G
H
J
K
L
M
N
P
R
MULTIPLIER
C184 5
V9 5654
C121 130
R34 1MEGO
J14
SMO MULTIPLIER INJECTION SIGNAL
C122 0.01 UF
R35 150K
R36 10K
C132 0.01 UF
C123 1000
2-4MC INPUT
P1-2
P1-1,9
T7
C18 330
C120 8-50
C19 330
Z25
S12
C131 180
C91 8-50
C130 20
C129 3-12
Z27
L27
C145 2
C146 1.5
C127 2
Z26
L26
C125 3-12
C126 27
C185 20
S13
SMO MULTIPLIER INJECTION SIGNAL
J15
MULTIPLIER
V10 5749
R37 470K
R38 270
C134 0.01 UF
C135 0.01 UF
R40 1K
S14
S17
C178 390
C177 330
Z28
C176 8-50
C137 68
C138 5-25
T8
2-4MC (B-2)
6-12MC (B-3)
S15
C139
C143 24
C144 4
Z29
C140 24
L29
C141 3-12
C142 0.01 UF
Z30
C148 36
C149 3-12
T9
14-28 MC (B-4)
L36 3.3
R66 4700
C186 33
C133 1000
L33 1MH 19a
R39 3300
1
16
18
10
31
35
27
+150V DC CONTINUOUS
TGC INPUT

Figure 5-102. Converter-Oscillator CV-731/URC, R-F Tuner Module, Model A, Schematic Diagram (Sheet 1 of 2)

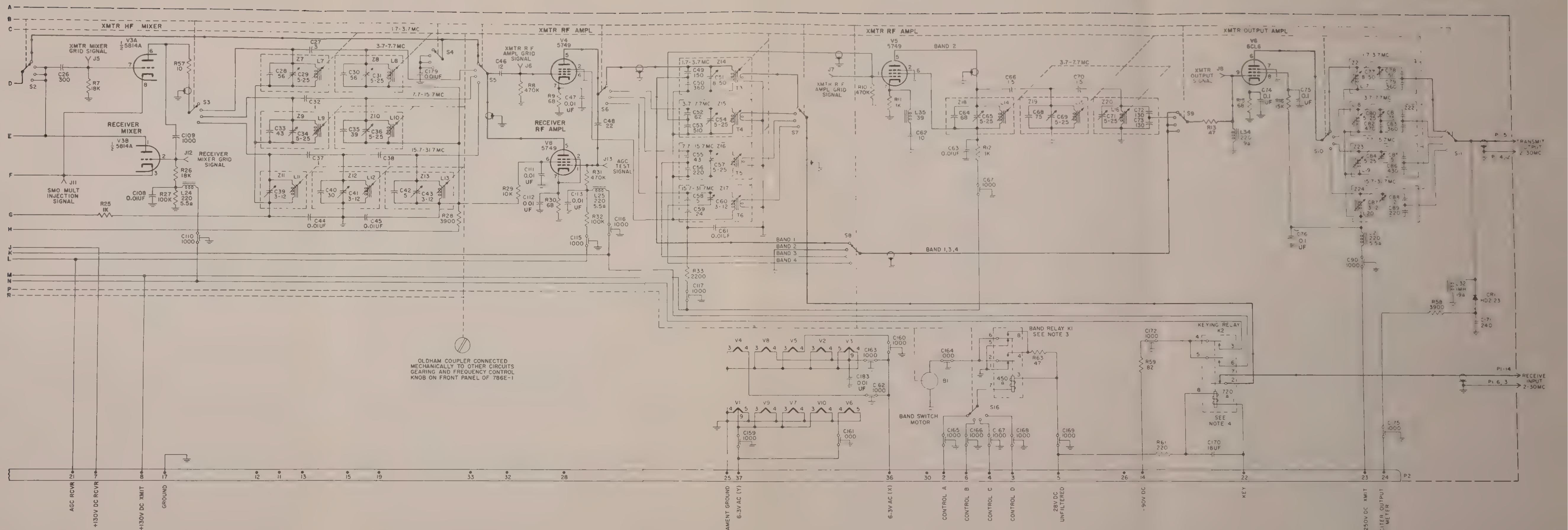

XMTR HF MIXER
XMTR MIXER GRID SIGNAL
V3A ½ 5814A
RECEIVER MIXER
V3B ½ 5814A
RECEIVER MIXER GRID SIGNAL
SMO MULT INJECTION SIGNAL
XMTR RF AMPL
V4 5749
XMTR R F AMPL GRID SIGNAL
RECEIVER RF AMPL
V8 5749
AGC TEST SIGNAL
V5 5749
XMTR R F AMPL GRID SIGNAL
BAND 2
BAND 1,3,4
BAND 1
BAND 2
BAND 3
BAND 4
XMTR OUTPUT AMPL
V6 6CL6
XMTR OUTPUT SIGNAL
TRANSMIT OUTPUT 2-30MC
RECEIVE INPUT 2-30MC
1.7-3.7MC
3.7-7.7MC
7.7-15.7MC
15.7-31.7MC
OLDHAM COUPLER CONNECTED MECHANICALLY TO OTHER CIRCUITS GEARING AND FREQUENCY CONTROL KNOB ON FRONT PANEL OF 786E-1
BAND RELAY K1 SEE NOTE 3
KEYING RELAY K2
SEE NOTE 4
BAND SWITCH MOTOR
B1
AGC RCVR
+130V DC RCVR
+130V DC XMIT
GROUND
FILAMENT GROUND
6.3V AC (Y)
6.3V AC (X)
CONTROL A
CONTROL B
CONTROL C
CONTROL D
28V DC UNFILTERED
-90V DC
KEY
+250V DC XMIT
EXCITER OUTPUT METER
P2

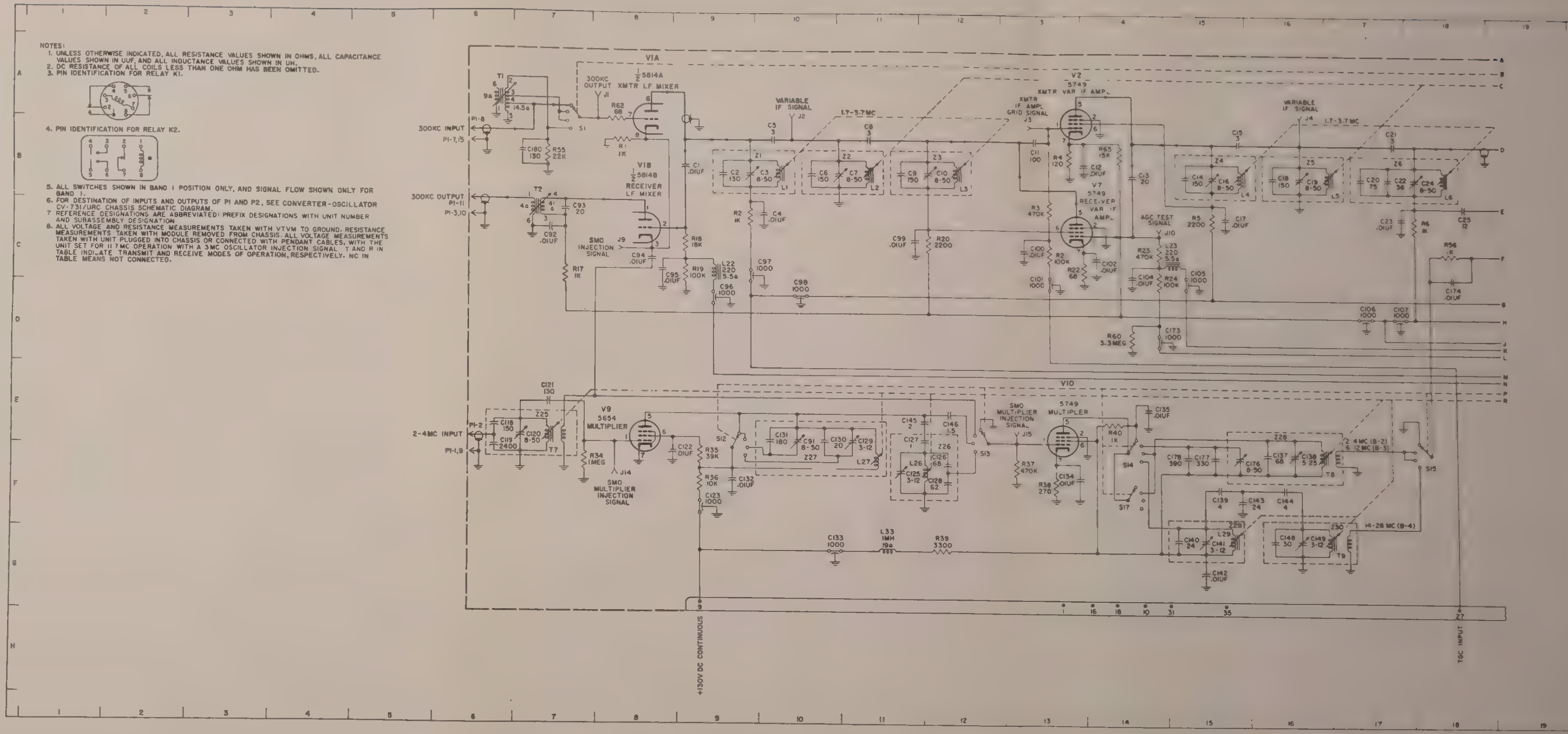
Figure 5-102. Converter-Oscillator CV-731/URC, R-F Tuner Module, Model A, Schematic Diagram (Sheet 2 of 2)

PART LOCATION INDEX

REF DESIG	LOC
C1	9B
C2	9B
C3	10B
C4	10C
C5	10B
C6	10B
C7	11B
C8	11B
C10	12B
C11	13B
C12	14B
C13	14B
C14	15B
C15	15B
C16	15B
C17	15C
C18	16B
C19	16B
C20	17B
C21	17B
C22	17B
C23	17C
C24	18B
C25	18C
C26	21B
C27	24B
C28	24B
C29	24B
C30	25B
C31	25B
C32	24B
C33	24C
C34	24C
C35	25C
C36	25C
C37	24C
C38	26C
C39	24C
C40	24C
C41	25C
C42	26C
C43	26D
C44	24D
C45	25D
C46	27B
C47	28B
C48	28B
C49	30B
C50	30B
C51	30B
C52	30B
C53	30B
C54	30B
C55	30C
C56	30C
C57	30C
C58	30D
C59	30D
C60	30D
C61	30D
C62	33B
C63	34C
C64	34B
C65	34B
C66	35B
C67	34C
C68	35B
C69	35B
C70	36B
C71	36B
C72	37B
C73	37B
C74	38B
C75	39B
C76	39D
C77	40B
C78	40B
C79	40B
C80	40B
C81	41B
C82	40B
C83	41B
C84	40C
C85	41C
C86	41C
C87	40C
C88	41C
C89	40D
C90	40D
C91	10E
C92	7C
C93	7C
C94	8C
C95	8C
C97	10C
C98	10D
C99	11C
C100	13C
C101	13C
C102	14C
C104	14C
C105	15C
C106	17D
C107	17D
C108	22D
C109	23C
C110	23D
C111	28C
C112	28D
C113	28D
C115	29D
C116	29D
C117	30E
C118	6E
C119	6E
C120	7E
C121	7E
C122	8F
C123	9F
C125	11F
C126	12F
C127	12E
C128	12F
C129	11E
C130	10E
C131	10E
C132	9F
C133	10G
C134	13F
C135	14E
C137	16F
C138	16F
C139	15F
C140	15G
C141	15G
C142	15G
C143	16F
C144	16F
C145	12E
C146	12E
C148	16G
C149	16G
C159	31G
C160	33F
C161	32G
C162	33F
C163	33F
C164	34F
C165	34G
C166	34G
C167	35G
C168	35G
C169	35G
C170	38G
C171	42E
C172	37F
C173	15D
C174	18C
C175	40G
C176	15F
C177	15F
C178	15F
C179	26B
C180	7B
C183	32H
CR1	42E
J1	8A
J2	10A
J3	13A
J4	16A
J5	21B
J6	28B
J7	32B
J8	38B
J9	8C
J10	14C
J11	21C
J12	23C
J13	29C
J14	8F
J15	13E
R1	8B
R2	9C
R3	13C
R4	13B
R5	15C
R6	18C
R7	21B
R8	28B
R9	28B
R10	33B
R11	33B
R12	34C
R13	38B
R15	38B
R16	39B
R17	7C
R18	9C
R19	9C
R20	12C
R21	13C
R22	14C
R23	14C
R24	14C
R25	21E
R26	23C
R27	22-D
R28	27-D
R29	28-C
R30	28-D
R31	29-C
R32	29D
R33	30E
R34	7F
R34	9F
R36	9F
R37	13F
R38	13F
R39	12G
R40	14E
R55	7B
R56	18C
R57	23-B
R58	41E
R59	37F
R60	14D
R61	37G
R62	8A
R63	35F
R65	14B
L1	10B
L2	11B
L3	12B
L4	15B
L5	17B
L6	18B
L7	25B
L8	26B
L9	25C
L10	26B
L11	24C
L12	25C
L13	26C
L14	35B
L15	36B
L16	36B
L17	40B
L18	40B
L19	40C
L20	40D
L21	40D
L22	9C
L23	15C
L24	23C
L25	29C
L26	11F
L27	11F
L29	15G
L32	41E
L33	11G
L34	38C
Z1	10B
Z2	11B
Z3	12B
Z4	15B
Z5	16B
Z6	17B
Z7	24-B
Z8	25B
Z9	24B
Z10	25B
Z11	24C
Z12	25C
Z13	26C
Z14	30B
Z15	30B
Z16	30C
Z17	30D
Z18	34B
Z19	35B
Z20	36B
Z21	40B
Z23	40C
Z24	40D
Z25	7E
Z26	12E
Z27	10E
Z28	16E
Z29	15G
Z30	16G
S1	7A
S2	20B
S3	23B
S4	26B
S5	27B
S6	29B
S7	32B
S8	32D
S9	37B
S10	40C
S11	41C
S12	9E
S13	12E
S14	14F
S15	18E
S16	34G
S17	14F
K1	35F
K2	38F
T1	6A
T2	7C
T3	31B
T4	31B
T5	31C
T6	31D
T7	7E
T8	17F
T9	17G
V1A	8A
V1B	8B
V2	13A
V3A	22B
V3B	22C
V4	28B
V5	33B
V6	38B
V7	14B
V8	28C
V9	8E
V10	13E

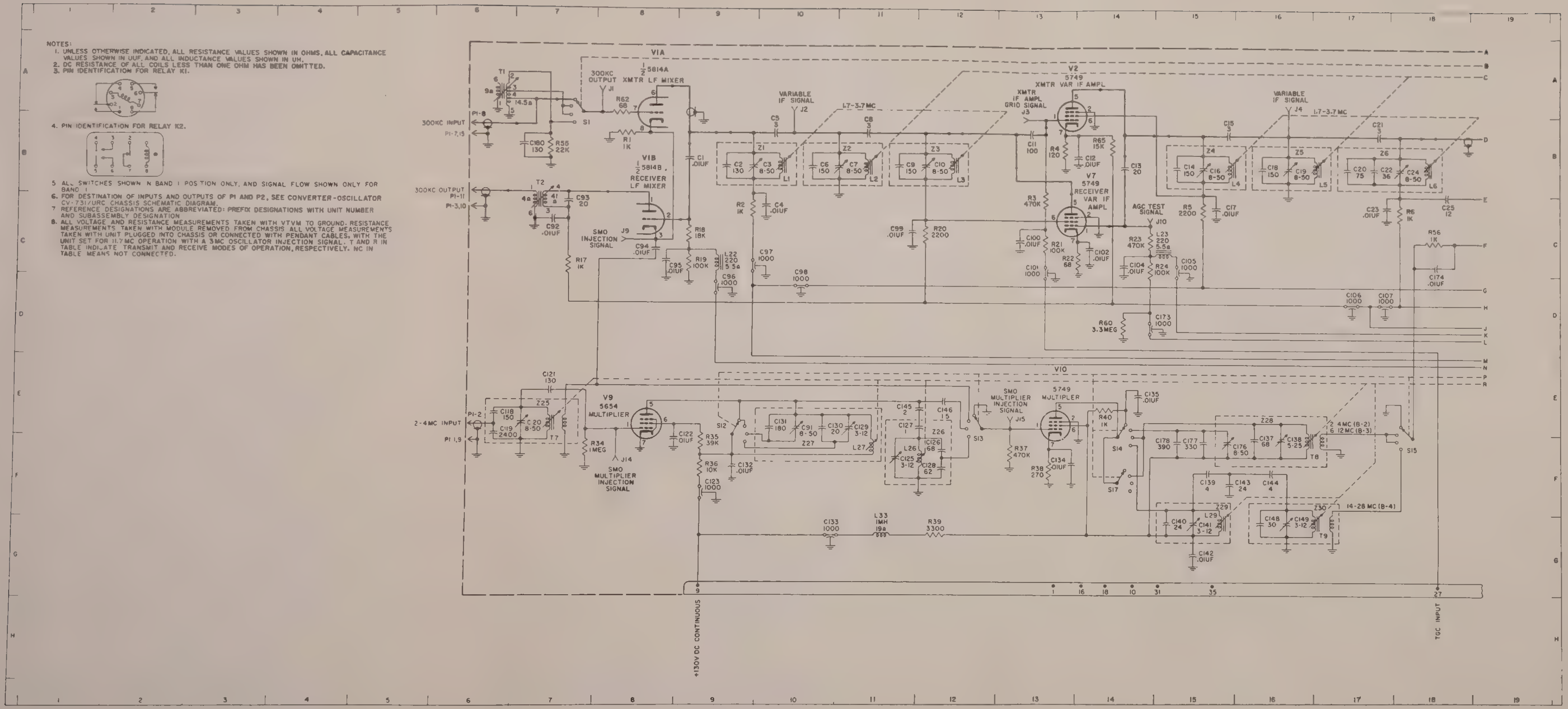
VACUUM TUBE VOLTAGE AND RESISTANCE CHART FOR CONVERTER-OSCILLATOR CV-731/URC, R-F TUNER MODULE, MODEL B

TUBE		PIN NUMBERS								
		1	2	3	4	5	6	7	8	9
V1	V	T -1.8V R 130V	T -90V R 0	4.2V	0	0	T 130V R -0.9V	0	4.2V	6.3VAC
	R	INF	30K	1K	INF	INF	INF	9	1K	INF
V2	V	T 0 R 0.65V	0	0	6.3VAC	T 110V R -0.9V	T 110V R -0.9V	T 1.5V R 0	NC	
	R	INF	0	INF	INF	INF	INF	130	NC	
V3	V	T -1.8V R 130V	T -90V R 0	4.2V	0	0	T 135V R -0.9V	0	4.2V	6.3VAC
	R	INF	28K	1K	INF	INF	INF	INF	1K	INF
V4	V	T 0 R -0.6V	0	0	6.3VAC	T 110V R -0.9V	T 110V R -0.9V	T 0 R 5.6V	NC	
	R	470K	0	INF	INF	INF	INF	68	NC	
V5	V	T 0 R -0.6V	0	0	6.3VAC	T 130V R -0.9V	T 130V R -0.9V	0	NC	
	R	470K	0	INF	INF	INF	INF	1K	NC	
V6	V	T 2.75V R 0	T 0 R -0 5V	T 155V R -0.6V	0	6.3VAC	T 250V R -1.6V	0	T 155V R -1 6V	T 0 R -0.5V
	R	68	100K	INF	INF	INF	INF	0	INF	100K
V7	V	T -90V R -0.5V	0	0	6.3VAC	T -1.8V R110V	T 1.8V R 110V	T 0 R 0.9V	NC	
	R	3.8 MEG	0	INF	INF	INF	INF	INF	NC	
V8	V	T -90V R -0.3V	T 0 R 0.6V	0	6.3VAC	T -1.8V R 100V	T -1.8V R 100V	T 0 R 0.6V	NC	
	R	3.8 MEG	INF	INF	INF	INF	INF	INF	NC	
V9	V	-35V	0	0	6.3VAC	110V	90V	0	NC	
	R	1 MEG	0	INF	INF	INF	INF	0	NC	
V10	V	0	0	0	6.3VAC	110V	110V	3.3V	NC	
	R	470K	0	INF	INF	INF	INF	270	NC	



NOTES:
1. UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES SHOWN IN OHMS, ALL CAPACITANCE VALUES SHOWN IN UUF, AND ALL INDUCTANCE VALUES SHOWN IN UH.
2. DC RESISTANCE OF ALL COILS LESS THAN ONE OHM HAS BEEN OMITTED.
3. PIN IDENTIFICATION FOR RELAY K1.
4. PIN IDENTIFICATION FOR RELAY K2.
5. ALL SWITCHES SHOWN IN BAND 1 POSITION ONLY, AND SIGNAL FLOW SHOWN ONLY FOR BAND 1.
6. FOR DESTINATION OF INPUTS AND OUTPUTS OF P1 AND P2, SEE CONVERTER-OSCILLATOR CV-731/URC CHASSIS SCHEMATIC DIAGRAM.
7. REFERENCE DESIGNATIONS ARE ABBREVIATED: PREFIX DESIGNATIONS WITH UNIT NUMBER AND SUBASSEMBLY DESIGNATION.
8. ALL VOLTAGE AND RESISTANCE MEASUREMENTS TAKEN WITH VTVM TO GROUND. RESISTANCE MEASUREMENTS TAKEN WITH MODULE REMOVED FROM CHASSIS. ALL VOLTAGE MEASUREMENTS TAKEN WITH UNIT PLUGGED INTO CHASSIS OR CONNECTED WITH PENDANT CABLES, WITH THE UNIT SET FOR 11.7MC OPERATION WITH A 3MC OSCILLATOR INJECTION SIGNAL. T AND R IN TABLE INDICATE TRANSMIT AND RECEIVE MODES OF OPERATION, RESPECTIVELY. NC IN TABLE MEANS NOT CONNECTED.

Figure 5-103. Converter-Oscillator CV-731/URC, R-F Tuner Module, Model B, Schematic Diagram (Sheet 1 of 2)



NOTES:
1. UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES SHOWN IN OHMS, ALL CAPACITANCE VALUES SHOWN IN UUF, AND ALL INDUCTANCE VALUES SHOWN IN UH.
2. DC RESISTANCE OF ALL COILS LESS THAN ONE OHM HAS BEEN OMITTED.
3. PIN IDENTIFICATION FOR RELAY K1.
4. PIN IDENTIFICATION FOR RELAY K2.
5. ALL SWITCHES SHOWN IN BAND I POSITION ONLY, AND SIGNAL FLOW SHOWN ONLY FOR BAND I.
6. FOR DESTINATION OF INPUTS AND OUTPUTS OF P1 AND P2, SEE CONVERTER-OSCILLATOR CV-731/URC CHASSIS SCHEMATIC DIAGRAM.
7. REFERENCE DESIGNATIONS ARE ABBREVIATED: PREFIX DESIGNATIONS WITH UNIT NUMBER AND SUBASSEMBLY DESIGNATION.
8. ALL VOLTAGE AND RESISTANCE MEASUREMENTS TAKEN WITH VTVM TO GROUND. RESISTANCE MEASUREMENTS TAKEN WITH MODULE REMOVED FROM CHASSIS. ALL VOLTAGE MEASUREMENTS TAKEN WITH UNIT PLUGGED INTO CHASSIS OR CONNECTED WITH PENDANT CABLES, WITH THE UNIT SET FOR 11.7MC OPERATION WITH A 3MC OSCILLATOR INJECTION SIGNAL. T AND R IN TABLE INDICATE TRANSMIT AND RECEIVE MODES OF OPERATION, RESPECTIVELY. NC IN TABLE MEANS NOT CONNECTED.

Figure 5-103. Converter-Oscillator CV-731/URC, R-F Tuner Module, Model B, Schematic Diagram (Sheet 1 of 2)

VACUUM TUBE VOLTAGE AND RESISTANCE CHART FOR CONVERTER-OSCILLATOR CV-731/URC, R-F TUNER MODULE, MODEL B

TUBE		PIN NUMBERS								
		1	2	3	4	5	6	7	8	9
V1	V	T -1.8V R 130V	T -90V R 0	4.2V	0	0	T 130V R -0.9V	0	4.2V	6.3VAC
	R	INF	30K	1K	INF	INF	INF	9	1K	INF
V2	V	T 0 R 0.65V	0	0	6.3VAC	T 110V R -0.9V	T 110V R -0.9V	T 1.5V R 0	NC	
	R	INF	0	INF	INF	INF	INF	130	NC	
V3	V	T -1.8V R 130V	T -90V R 0	4.2V	0	0	T 135V R -0.9V	0	4.2V	6.3VAC
	R	INF	28K	1K	INF	INF	INF	INF	1K	INF
V4	V	T 0 R -0.6V	0	0	6.3VAC	T 110V R -0.9V	T 110V R -0.9V	T 0 R 5.6V	NC	
	R	470K	0	INF	INF	INF	INF	68	NC	
V5	V	T 0 R -0.6V	0	0	6.3VAC	T 130V R -0.9V	T 130V R -0.9V	0	NC	
	R	470K	0	INF	INF	INF	INF	1K	NC	
V6	V	T 2.75V R 0	T 0 R -0.5V	T 155V R -0.6V	0	6.3VAC	T 250V R -1.6V	0	T 155V R -1.6V	T 0 R -0.5V
	R	68	100K	INF	INF	INF	INF	0	INF	100K
V7	V	T -90V R -0.5V	0	0	6.3VAC	T -1.8V R110V	T 1.8V R 110V	T 0 R 0.9V	NC	
	R	3.8 MEG	0	INF	INF	INF	INF	INF	NC	
V8	V	T -90V R -0.3V	T 0 R 0.6V	0	6.3VAC	T -1.8V R 100V	T -1.8V R 100V	T 0 R 0.6V	NC	
	R	3.8 MEG	INF	INF	INF	INF	INF	INF	NC	
V9	V	-35V	0	0	6.3VAC	110V	90V	0	NC	
	R	1 MEG	0	INF	INF	INF	INF	0	NC	
V10	V	0	0	0	6.3VAC	110V	110V	2.3V	NC	
	R	470K	0	INF	INF	INF	INF	270	NC	

PART LOCATION INDEX

REF DESIG	LOC	REF DESIG	LOC	REF DESIG	LOC	REF DESIG	LOC	REF DESIG	LOC	REF DESIG	LOC
C1	9B	C61	30D	C123	9F	J12	23C	L7	25B	S6	29B
C2	9B	C62	33B	C125	11F	J13	29C	L8	26B	S7	32B
C3	10B	C63	34C	C126	12F	J14	8F	L9	25C	S8	32D
C4	10C	C64	34B	C127	12E	J15	13E	L10	26B	S9	37B
C5	10B	C65	34B	C128	12F	R1	8B	L11	24C	S10	40C
C6	10B	C66	35B	C129	11E	R2	9C	L12	25C	S11	41C
C7	11B	C67	34C	C130	10E	R3	13C	L13	26C	S12	9E
C8	11B	C68	35B	C131	10E	R4	13B	L14	35B	S13	12E
C10	12B	C69	35B	C132	9F	R5	15C	L15	36B	S14	14F
C11	13B	C70	36B	C133	10G	R6	18C	L16	36B	S15	18E
C12	14B	C71	36B	C134	13F	R7	21B	L17	40B	S16	34G
C13	14B	C72	37B	C135	14E	R8	28B	L18	40B	S17	14F
C14	15B	C73	37B	C137	16F	R9	28B	L19	40C	K1	35F
C15	15B	C74	38B	C138	16F	R10	33B	L20	40D	K2	38F
C16	15B	C75	39B	C139	15F	R11	33B	L21	40D	T1	6A
C17	15C	C76	39D	C140	15G	R12	34C	L22	9C	T2	7C
C18	16B	C77	40B	C141	15G	R13	38B	L23	15C	T3	31B
C19	16B	C78	40B	C142	15G	R15	38B	L24	23C	T4	31B
C20	17B	C79	40B	C143	16F	R16	39B	L25	29C	T5	31C
C21	17B	C80	40B	C144	16F	R17	7C	L26	11F	T6	31D
C22	17B	C81	41B	C145	12E	R18	9C	L27	11F	T7	7E
C23	17C	C82	40B	C146	12E	R19	9C	L29	15G	T8	17F
C24	18B	C83	41B	C148	16G	R20	12C	L32	41E	T9	17G
C25	18C	C84	40C	C149	16G	R21	13C	L33	11G	V1A	8A
C26	21B	C85	41C	C159	31G	R22	14C	L34	38C	V1B	8B
C27	24B	C86	41C	C160	33F	R23	14C	Z1	10B	V2	13A
C28	24B	C87	40C	C161	32G	R24	14C	Z2	11B	V3A	22B
C29	24B	C88	41C	C162	33F	R25	21E	Z3	12B	V3B	22C
C30	25B	C89	40D	C163	33F	R26	23C	Z4	15B	V4	28B
C31	25B	C90	40D	C164	34F	R27	22-D	Z5	16B	V5	33B
C32	24B	C91	10E	C165	34G	R28	27-D	Z6	17B	V6	38B
C33	24C	C92	7C	C166	34G	R29	28-C	Z7	24-B	V7	14B
C34	24C	C93	7C	C167	35G	R30	28-D	Z8	25B	V8	28C
C35	25C	C94	8C	C168	35G	R31	29-C	Z9	24B	V9	8E
C36	25C	C95	8C	C169	35G	R32	29D	Z10	25B	V10	13E
C37	24C	C97	10C	C170	38G	R33	30E	Z11	24C		
C38	26C	C98	10D	C171	42E	R34	7F	Z12	25C		
C39	24C	C99	11C	C172	37F	R34	9F	Z13	26C		
C40	24C	C100	13C	C173	15D	R36	9F	Z14	30B		
C41	25C	C101	13C	C174	18C	R37	13F	Z15	30B		
C42	26C	C102	14C	C175	40G	R38	13F	Z16	30C		
C43	26D	C104	14C	C176	15F	R39	12G	Z17	30D		
C44	24D	C105	15C	C177	15F	R40	14E	Z18	34B		
C45	25D	C106	17D	C178	15F	R55	7B	Z19	35B		
C46	27B	C107	17D	C179	26B	R56	18C	Z20	36B		
C47	28B	C108	22D	C180	7B	R57	23-B	Z21	40B		
C48	28B	C109	23C	C183	32H	R58	41E	Z23	40C		
C49	30B	C110	23D	CR1	42E	R59	37F	Z24	40D		
C50	30B	C111	28C	J1	8A	R60	14D	Z25	7E		
C51	30B	C112	28D	J2	10A	R61	37G	Z26	12E		
C52	30B	C113	28D	J3	13A	R62	8A	Z27	10E		
C53	30B	C115	29D	J4	16A	R63	35F	Z28	16E		
C54	30B	C116	29D	J5	21B	R65	14B	Z29	15G		
C55	30C	C117	30E	J6	28B	L1	10B	Z30	16G		
C56	30C	C118	6E	J7	32B	L2	11B	S1	7A		
C57	30C	C119	6E	J8	38B	L3	12B	S2	20B		
C58	30D	C120	7E	J9	8C	L4	15B	S3	23B		
C59	30D	C121	7E	J10	14C	L5	17B	S4	26B		
C60	30D	C122	8F	J11	21C	L6	18B	S5	27B		

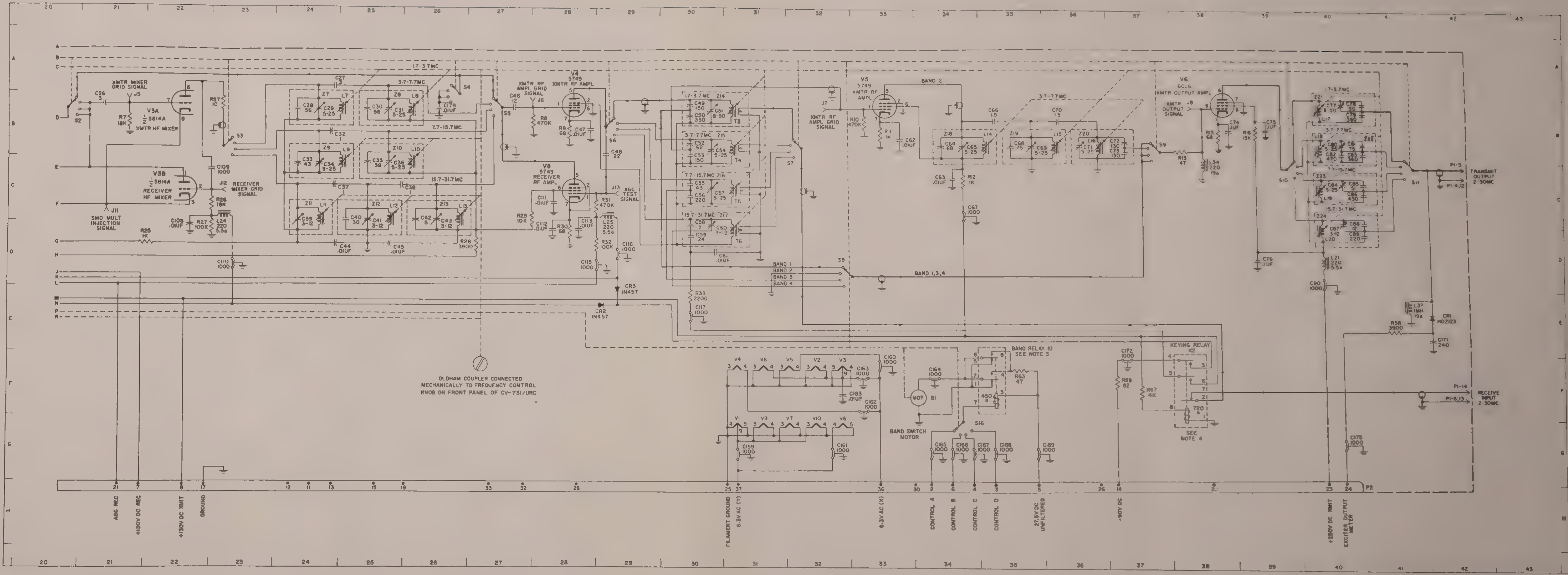
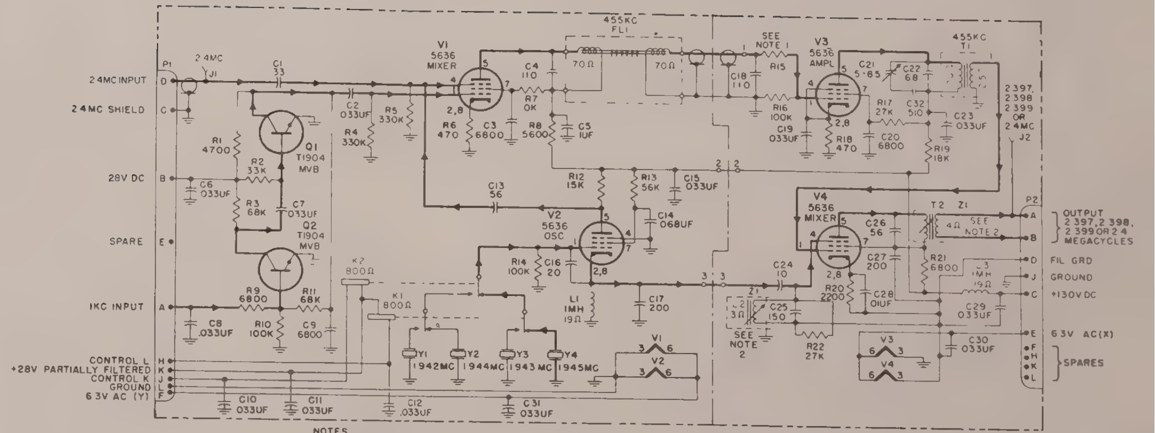

XMTR MIXER GRID SIGNAL
J5
V3A 1/2 5814A XMTR HF MIXER
V3B 1/2 5814A RECEIVER HF MIXER
J11 SMO MULT INJECTION SIGNAL
J12 RECEIVER MIXER GRID SIGNAL
1.7-3.7MC
3.7-7.7MC
7.7-15.7MC
15.7-31.7MC
XMTR RF AMPL GRID SIGNAL
J6
V4 5749 XMTR RF AMPL
V8 5749 RECEIVER RF AMPL
J13 AGC TEST SIGNAL
CR3 1N457
CR2 1N457
OLDHAM COUPLER CONNECTED MECHANICALLY TO FREQUENCY CONTROL KNOB ON FRONT PANEL OF CV-731/URC
J7 XMTR RF AMPL GRID SIGNAL
V5 5749 XMTR RF AMPL
BAND 2
BAND 1
BAND 2
BAND 3
BAND 4
BAND 1,3,4
V6 6CL6 XMTR OUTPUT AMPL
J8 XMTR OUTPUT SIGNAL
TRANSMIT OUTPUT 2-30MC
RECEIVE INPUT 2-30MC
BAND RELAY K1 SEE NOTE 3
KEYING RELAY K2
SEE NOTE 4
BAND SWITCH MOTOR
CR1 HD2123
AGC REC
+130V DC REC
+130V DC XMIT
GROUND
FILAMENT GROUND
6.3V AC (Y)
6.3V AC (X)
CONTROL A
CONTROL B
CONTROL C
CONTROL D
27.5V DC UNFILTERED
-90V DC
+250V DC XMIT
EXCITER OUTPUT METER
P2

Figure 5-103. Converter-Oscillator CV-731/URC, R-F Tuner Module, Model B, Schematic Diagram (Sheet 2 of 2)

VACUUM TUBE VOLTAGE AND RESISTANCE CHART FOR CONVERTER-OSCILLATOR CV-731/URC, SIDESTEP OSCILLATOR MODULE

TUBE		PIN NUMBERS							
		1	2	3	4	5	6	7	8
V1	V	13 VAC	+0.6V 3.4 VAC	0	-0.2V 3.5 VAC	+120V 2 VAC	6.3 VAC	+110V	+0.64V 3.4 VAC
	R	330K	470	0	330K	INF	2	INF	470
V2	V	-0.2V 2.5 VAC	1.3 VAC	0	0	+110V	6.3 VAC	+36V	3.2 VAC
	R	47K	7	0	0	INF	2	INF	7
V3	V	0	+0.3V	0	+0.47V	+2.4V	6.3 VAC	+21V	+0.47V
	R	65	470	0	470	INF	2	INF	470
V4	V	0.45 VAC	+4V	0	3.8 VAC	+110V 4 VAC	6.3 VAC	+110V	+4.2V
	R	27	2200	0	1.4	INF	2	INF	2200

TRANSISTOR		PIN DESIGNATION		
		E	B	C
Q1	V	0	+4.9V 11.5 VAC	+0.25V 0.37 VAC
	R	0	175K	240K
Q2	V	0	+6V 6 VAC	-0.8V 1.15V
	R	0	240K	100K


P1
2.4MC INPUT
2.4MC SHIELD
28V DC
SPARE
1KC INPUT
CONTROL L
+28V PARTIALLY FILTERED
CONTROL K
GROUND
6.3V AC (Y)
2.4MC
J1
C1 33
C2 .033UF
C6 .033UF
C7 .033UF
C8 .033UF
C9 6800
C10 .033UF
C11 .033UF
C12 .033UF
C31 .033UF
R1 4700
R2 33K
R3 68K
R4 330K
R5 330K
R9 6800
R10 100K
R11 68K
Q1 T1904 MVB
Q2 T1904 MVB
K2 800Ω
K1 800Ω
Y1 1942MC
Y2 1944MC
Y3 1943 MC
Y4 1945MC
V1 5636 MIXER
R6 470
C3 6800
C4 110
R7 0K
R8 5600
C5 1UF
C13 56
R12 15K
R13 56K
C15 .033UF
C14 .068UF
V2 5636 OSC
R14 100K
C16 20
L1 1MH 19Ω
C17 200
455KC FL1
70Ω
70Ω
SEE NOTE 1
R15
C18 110
R16 100K
C19 .033UF
V3 5636 AMPL
R18 470
C20 6800
C21 5-85
C22 68
C32 510
R17 27K
C23 .033UF
R19 18K
455KC T1
2397, 2398, 2399 OR 2.4MC
J2
V4 5636 MIXER
C24 10
C26 56
C27 200
R20 2200
C28 .01UF
T2
Z1
4Ω
SEE NOTE 2
R21 6800
L3 1MH 19Ω
C29 .033UF
L2 3Ω
C25 150
SEE NOTE 2
R22 27K
C30 .033UF
P2
OUTPUT 2.397, 2.398, 2.399 OR 2.4 MEGACYCLES
FIL GRD
GROUND
+130V DC
6.3V AC(X)
SPARES

NOTES

1. FINAL VALUE DETERMINED BY PRODUCTION TEST. NOMINAL VALUE. 39K.
2. T2 AND L2 ARE TOROIDS SEPARATED BY A GROUNDED COPPER SHIELD AND ENCLOSED IN ONE POTTED ASSEMBLY, Z1.
3. UNLESS OTHERWISE INDICATED:
   ALL RESISTANCE VALUES ARE IN OHMS,
   ALL CAPACITANCE VALUES ARE IN UUF
4. REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATIONS WITH UNIT NUMBER AND SUBASSEMBLY DESIGNATION.
5. DC RESISTANCE OF COILS LESS THAN ONE OHM HAS BEEN OMITTED
6. FOR DESTINATION OF INPUTS AND OUTPUTS OF P1 AND P2, SEE CONVERTER-OSCILLATOR CV-731/URC CHASSIS SCHEMATIC DIAGRAM.
7. ALL VOLTAGE AND RESISTANCE MEASUREMENTS TAKEN WITH VTVM TO GROUND. RESISTANCE MEASUREMENTS TAKEN WITH MODULE REMOVED FROM CHASSIS. ALL VOLTAGE MEASUREMENTS TAKEN WITH UNIT PLUGGED INTO CHASSIS OR CONNECTED BY PENDANT CABLES AND WITH BANDSWITCH IN ADD 1, 2, OR 3. BE CAREFUL IN MEASURING RESISTANCE AT TRANSISTOR TERMINALS TO OBSERVE THE PROPER POLARITY AND TO USE THE HIGHEST METER RANGE PRACTICABLE TO AVOID EXCESSIVE BASE CURRENT. BE SURE TO GROUND THE COMMON LEAD OF THE VTVM WHEN MAKING RESISTANCE MEASUREMENTS ON TRANSISTORS
8. MOD A DOES NOT APPLY.
   MOD B C1, 33 WAS 10
   C7, .033UF WAS .01UF.
   C9, 6800 WAS .01UF
   R2, 33K, WAS 68K
   MOD C R22, 27K ADDED
   MOD D C27, 200 UUF WAS .033UF

Figure 5-104. Converter-Oscillator CV-731/URC, Sidestep Oscillator Module, Schematic Diagram

NOTES:

1. UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES IN UUF, AND ALL INDUCTANCE VALUES IN MICROHENRYS.
2. FINAL VALUE DETERMINED BY PRODUCTION TESTS
3. FL1, A3FL1, AND A6FL1 ARE NON-REPAIRABLE ITEMS, COMPONENTS SHOWN ARE REPRESENTATIVE ONLY
4. DC RESISTANCE OF ALL COILS LESS THAN ONE OHM HAS BEEN OMITTED
5. FOR DESTINATION OF INPUTS AND OUTPUTS OF P1, SEE FREQUENCY GENERATOR 786E-1 CHASSIS SCHEMATIC DIAGRAM
6. REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATIONS WITH UNIT NUMBER AND SUBASSEMBLY DESIGNATIONS
7. ALL RESISTANCE AND VOLTAGE MEASUREMENTS TAKEN WITH VTVM TO GROUND RESISTANCE MEASUREMENTS TAKEN WITH ALL SUBASSEMBLIES PLUGGED IN AND SMO UNPLUGGED FROM CHASSIS. VOLTAGE MEASUREMENTS TAKEN WITH UNIT PLUGGED INTO CHASSIS OR CONNECTED BY PENDANT CABLES MEASUREMENTS NOT GIVEN ON MASTER OSCILLATOR, SINCE SUBASSEMBLY IS A SEALED UNIT. NC IN TABLE MEANS NOT CONNECTED. BE CAREFUL IN MEASURING RESISTANCE AT TRANSISTOR TERMINALS TO OBSERVE PROPER POLARITY AND TO USE HIGHEST METER RANGE PRACTICABLE TO AVOID EXCESSIVE BASE CURRENT IN THE TRANSISTORS BE SURE TO GROUND THE COMMON LEAD OF THE VTVM WHEN MAKING RESISTANCE MEASUREMENTS ON TRANSISTORS

REF DES		PIN NUMBERS								
		1	2	3	4	5	6	7	8	9
V1	V	-13V	0	0	6.3VAC	130V	32V	0		
	R	11MEG	0	0	0.2	75K	15K	0		
V2	V	0	2.25V	0	6.3VAC	128V	82V	0		
	R	0	330	0	0.2	65K	72K	48K		
V3	V	-17V	0	0	6.3VAC	11V	50V	0		
	R	10K	0	0	0.2	110K	90K	0		
V4	V	6.3VAC	6V	17V	54V	NC	62V	5.8V	6.4V	0
	R	0.2	2K	300	10K	NC	95K	48K	2K	0
A3V1	V	0	NC	6.3VAC	0	86V	0	86V	2.1V	
	R	15	NC	1	14	75K	0	75K	560	
A3V2	V	0	NC	0	0	84V	6.3VAC	84V	2.2V	
	R	4	NC	0	22K	75K	0.2	75K	560	
A5V1	V	8VAC -8V	1VAC	0	1VAC	80V 25VAC	6.3VAC	53V	1VAC	
	R	100K	0.5	0	0.5	90K	5	180K	0.5	
A6V1	V	0	2.1V	0	-0.1V	89V	6.3VAC	89V	NC	
	R	4	520	0.2	22K	75K	1	75K	NC	

REF DES		PIN DESIGNATION		
		e	c	b
A2Q1	V	0	7.6V	0.58V
	R	0	2K	940
A2Q2	V	0	6.2V	0.62V
	R	0	2200	950
A2Q3	V	13.5V	26V	15V
	R	5K	1K	2K
A2Q4	V	15.5V	15V	2.1V
	R	1200	7500	750
A2Q5	V	0.02V	25V	0.43V
	R	200	13K	13K
A2Q6	V	0.01V	24.5V	0.42V
	R	200	12.5K	13K
A6Q1	V	0	17V	0.23V
	R	0	12K	450
A6Q2	V	2.2V	2.8V	2.7V
	R	2200	12K	8500
A6Q3	V	1V	15V	1.65V
	R	2200	12.5K	9800
A7Q1	V	0.01V	26V	0.45V
	R	200	12K	13.5K
A7Q2	V	17V	7V	2.4V
	R	1500	8K	400
A7Q3	V	16V	26V	17V
	R	7K	1100	7500

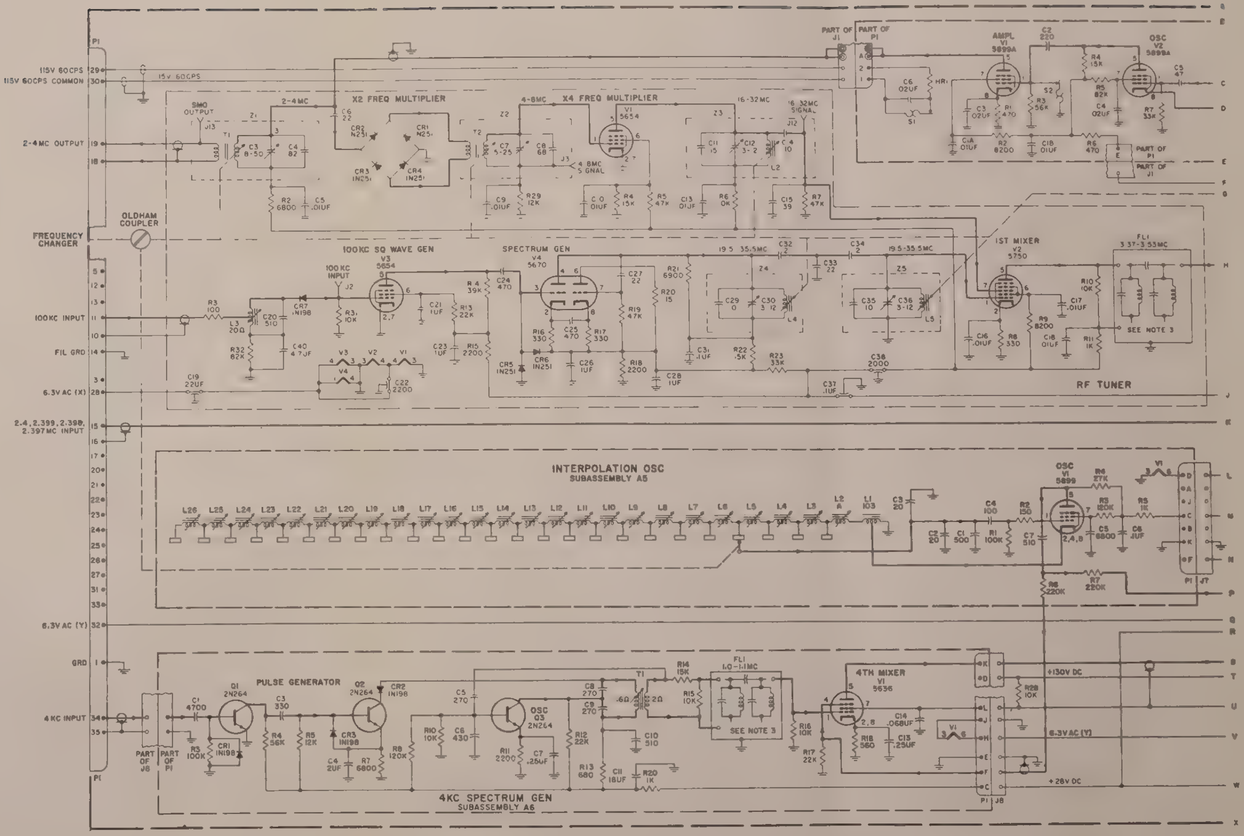

P1
115V 60CPS
115V 60CPS COMMON
2-4MC OUTPUT
FREQUENCY CHANGER
100KC INPUT
FIL GRD
6.3V AC (X)
2.4, 2.399, 2.398, 2.397MC INPUT
6.3V AC (Y)
GRD
4KC INPUT
SMO OUTPUT
J13
T1
2-4MC
X2 FREQ MULTIPLIER
4-8MC
X4 FREQ MULTIPLIER
16-32MC
16-32MC SIGNAL
J12
4-8MC SIGNAL
J3
OLDHAM COUPLER
100KC SQ WAVE GEN
100KC INPUT
J2
SPECTRUM GEN
19.5-35.5MC
1ST MIXER
FL1 3.37-3.53MC
SEE NOTE 3
RF TUNER
PART OF J1
PART OF P1
AMPL V1 5899A
OSC V2 5899A
INTERPOLATION OSC
SUBASSEMBLY A5
OSC V1 5899
PULSE GENERATOR
Q1 2N264
Q2 2N264
OSC Q3 2N264
FL1 1.0-1.1MC
4TH MIXER V1 5636
+130V DC
6.3V AC (Y)
+28V DC
4KC SPECTRUM GEN
SUBASSEMBLY A6
PART OF J8
PART OF P1
A
B
C
D
E
F
G
H
J
K
L
M
N
P
Q
R
S
T
U
V
W
X

Figure 5-105. Converter-Oscillator CV-731/URC, Stabilized Master Oscillator Module (SMO), Model A, Schematic Diagram (Sheet 1 of 2)

NOTES:

1. UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES IN UUF, AND ALL INDUCTANCE VALUES IN MICROHENRYS.
2. FINAL VALUE DETERMINED BY PRODUCTION TESTS.
3. FL1, A3FL1, AND A6FL1 ARE NON-REPAIRABLE ITEMS, COMPONENTS SHOWN ARE REPRESENTATIVE ONLY.
4. DC RESISTANCE OF ALL COILS LESS THAN ONE OHM HAS BEEN OMITTED.
5. FOR DESTINATION OF INPUTS AND OUTPUTS OF P1, SEE FREQUENCY GENERATOR 786E-1 CHASSIS SCHEMATIC DIAGRAM.
6. REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATIONS WITH UNIT NUMBER AND SUBASSEMBLY DESIGNATIONS.
7. ALL RESISTANCE AND VOLTAGE MEASUREMENTS TAKEN WITH VTVM TO GROUND RESISTANCE MEASUREMENTS TAKEN WITH ALL SUBASSEMBLIES PLUGGED IN AND SMO UNPLUGGED FROM CHASSIS. VOLTAGE MEASUREMENTS TAKEN WITH UNIT PLUGGED INTO CHASSIS OR CONNECTED BY PENDANT CABLES MEASUREMENTS NOT GIVEN ON MASTER OSCILLATOR, SINCE SUBASSEMBLY IS A SEALED UNIT. NC IN TABLE MEANS NOT CONNECTED. BE CAREFUL IN MEASURING RESISTANCE AT TRANSISTOR TERMINALS TO OBSERVE PROPER POLARITY AND TO USE HIGHEST METER RANGE PRACTICABLE TO AVOID EXCESSIVE BASE CURRENT IN THE TRANSISTORS BE SURE TO GROUND THE COMMON LEAD OF THE VTVM WHEN MAKING RESISTANCE MEASUREMENTS ON TRANSISTORS

REF DES		PIN NUMBERS								
		1	2	3	4	5	6	7	8	9
V1	V	-13V	0	0	6.3VAC	130V	32V	0		
	R	11MEG	0	0	0.2	75K	16K	0		
V2	V	0	2.25V	0	6.3VAC	128V	82V	0		
	R	0	330	0	0.2	65K	72K	48K		
V3	V	-1.7V	0	0	6.3VAC	11V	50V	0		
	R	10K	0	0	0.2	110K	90K	0		
V4	V	6.3VAC	6V	17V	54V	NC	62V	5.8V	6.4V	0
	R	0.2	2K	300	110K	NC	95K	48K	2K	0
A3V1	V	0	NC	6.3VAC	0	86V	0	86V	2.1V	
	R	15	NC	1	14	75K	0	75K	560	
A3V2	V	0	NC	0	0	84V	6.3VAC	84V	2.2V	
	R	4	NC	0	22K	75K	0.2	75K	560	
A5V1	V	8VAC -8V	1VAC	0	1VAC	80V 25VAC	6.3VAC	53V	1VAC	
	R	100K	0.5	0	0.5	90K	5	180K	0.5	
A6V1	V	0	2.1V	0	-0.1V	89V	6.3VAC	89V	NC	
	R	4	520	0.2	22K	75K	1	75K	NC	

REF DES		PIN DESIGNATION		
		e	c	b
A2Q1	V	0	7.6V	0.58V
	R	0	2K	940
A2Q2	V	0	6.2V	0.62V
	R	0	2200	950
A2Q3	V	13.5V	26V	15V
	R	5K	1K	2K
A2Q4	V	15.5V	15V	2.1V
	R	1200	7500	750
A2Q5	V	0.02V	25V	0.43V
	R	200	13K	13K
A2Q6	V	0.01V	24.5V	0.42V
	R	200	12.5K	13K
A6Q1	V	0	12V	0.23V
	R	0	12K	450
A6Q2	V	2.2V	2.8V	2.7V
	R	2200	12K	8500
A6Q3	V	1.1V	15V	1.65V
	R	2200	12.5K	9800
A7Q1	V	0.01V	26V	0.45V
	R	200	12K	13.5K
A7Q2	V	1.7V	17V	2.4V
	R	1500	8K	1400
A7Q3	V	16V	26V	17V
	R	7K	1100	7500

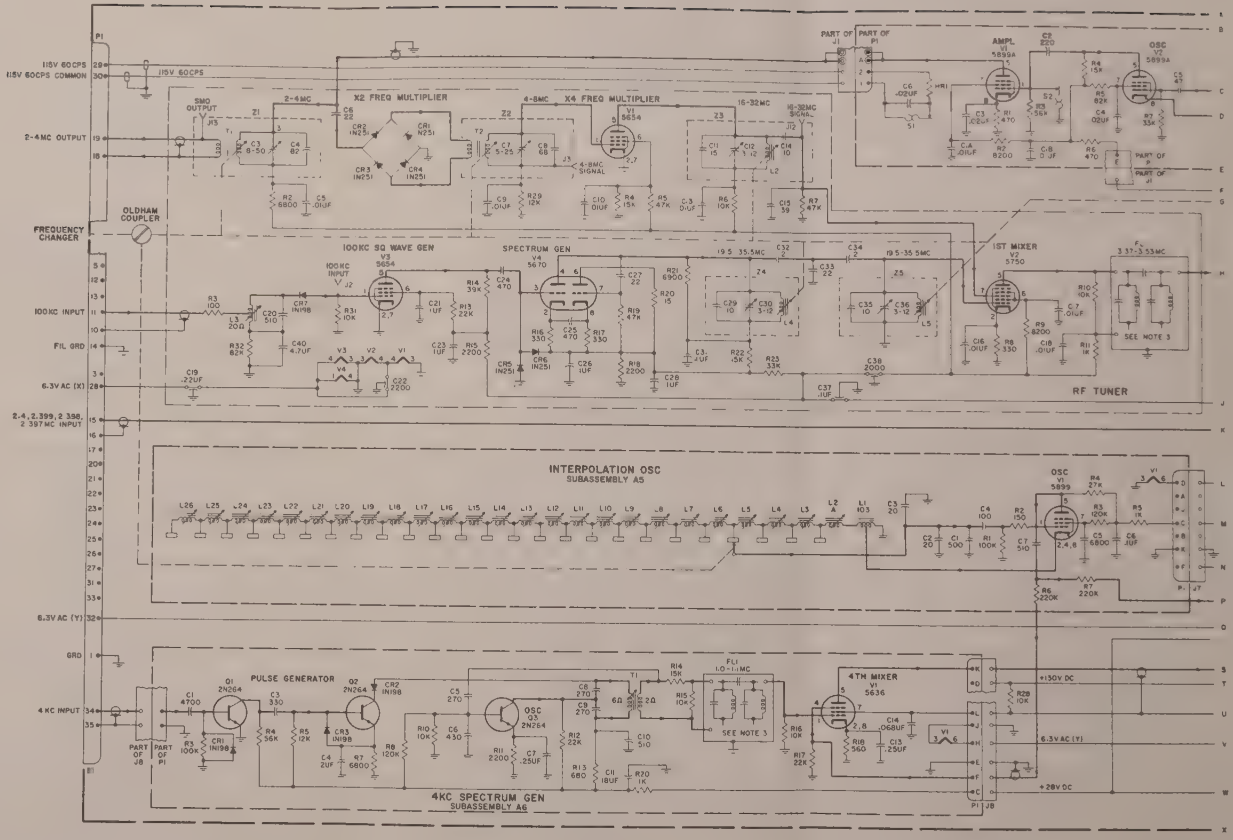

P1
115V 60CPS
115V 60CPS COMMON
2-4MC OUTPUT
FREQUENCY CHANGER
100KC INPUT
FIL GRD
6.3V AC (X)
2.4, 2.399, 2.398, 2.397MC INPUT
6.3V AC (Y)
GRD
4 KC INPUT
SMO OUTPUT
J13
Z1
2-4MC
X2 FREQ MULTIPLIER
CR2 1N251
CR1 1N251
CR3 1N251
CR4 1N251
T2
Z2
4-8MC
X4 FREQ MULTIPLIER
V1 5654
4-8MC SIGNAL
J3
16-32MC
Z3
16-32MC SIGNAL
J12
PART OF J1
PART OF P1
AMPL V1 5899A
OSC V2 5899A
S1
S2
HR1
OLDHAM COUPLER
100KC SQ WAVE GEN
100KC INPUT
J2
V3 5654
SPECTRUM GEN
V4 5670
19.5-35.5MC
Z4
Z5
19.5-35.5MC
1ST MIXER
V2 5750
3.37-3.53MC
SEE NOTE 3
RF TUNER
INTERPOLATION OSC
SUBASSEMBLY A5
L26 L25 L24 L23 L22 L21 L20 L19 L18 L17 L16 L15 L14 L13 L12 L11 L10 L9 L8 L7 L6 L5 L4 L3 L2 L1
OSC V1 5899
PULSE GENERATOR
Q1 2N264
Q2 2N264
OSC Q3 2N264
FL1 1.0-1.1MC
SEE NOTE 3
4TH MIXER
V1 5636
4KC SPECTRUM GEN
SUBASSEMBLY A6
PART OF J8
PART OF P1
P1 J8
+130V DC
6.3V AC (Y)
+28V DC
A B C D E F G H J K L M N P Q S T U V W X

Figure 5-105. Converter-Oscillator CV-731/URC, Stabilized Master Oscillator Module (SMO), Model A, Schematic Diagram (Sheet 1 of 2)

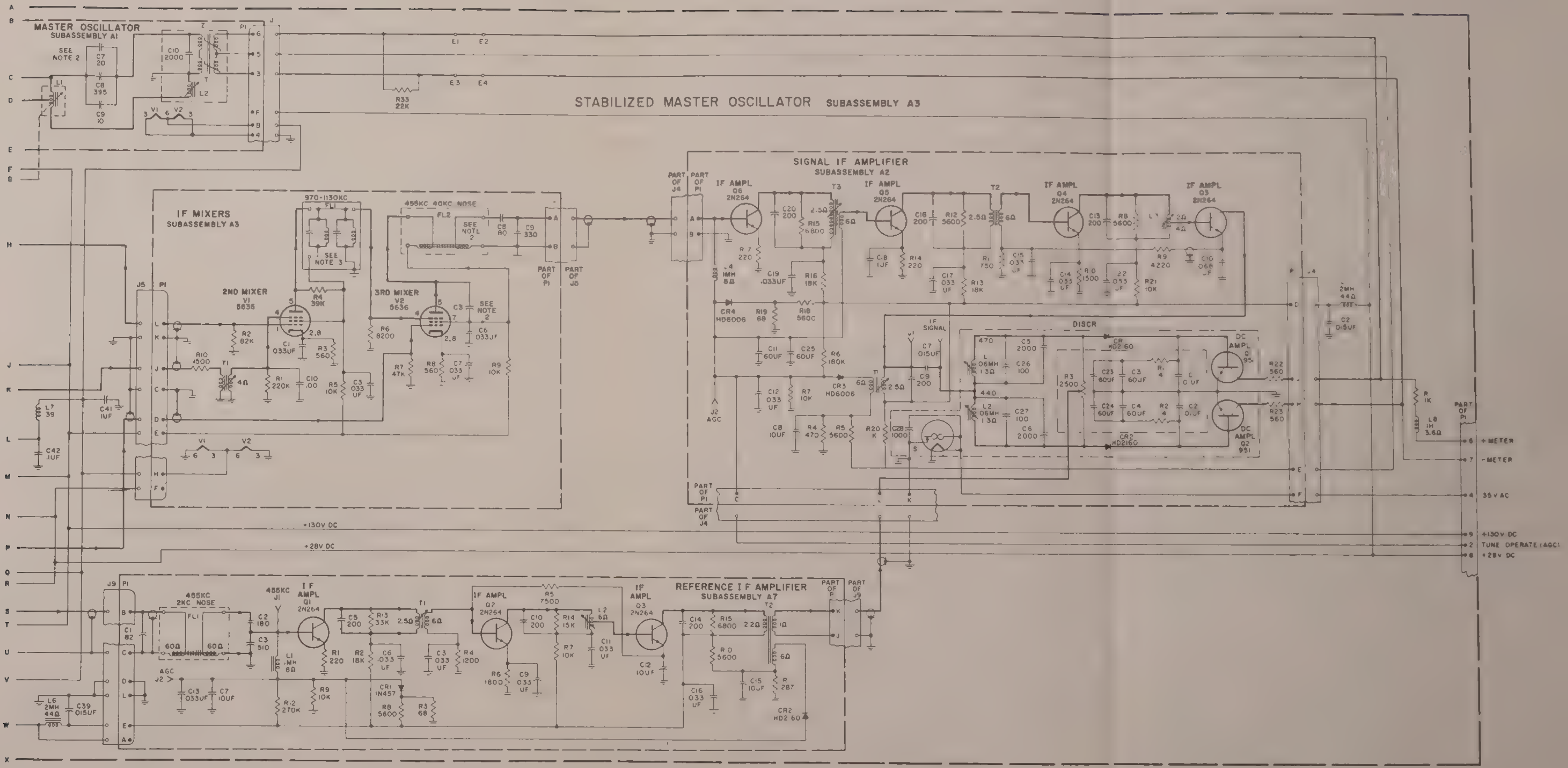

MASTER OSCILLATOR
SUBASSEMBLY A1
SEE NOTE 2
STABILIZED MASTER OSCILLATOR SUBASSEMBLY A3
R33
22K
E1
E2
E3
E4
IF MIXERS
SUBASSEMBLY A3
970-1130KC
FL1
SEE NOTE 3
455KC 40KC NOSE
FL2
2ND MIXER
V1
5636
3RD MIXER
V2
5636
PART OF P1
PART OF J5
PART OF J4
SIGNAL IF AMPLIFIER
SUBASSEMBLY A2
IF AMPL
Q6
2N264
IF AMPL
Q5
2N264
IF AMPL
Q4
2N264
IF AMPL
Q3
2N264
CR4
HD6006
CR3
HD6006
J2
AGC
IF SIGNAL
DISCR
DC AMPL
Q1
951
DC AMPL
Q2
951
+130V DC
+28V DC
+METER
-METER
35 V AC
+130V DC
TUNE OPERATE (AGC)
+28V DC
PART OF P1
REFERENCE I F AMPLIFIER
SUBASSEMBLY A7
455KC
2KC NOSE
FL1
455KC
J1
I F AMPL
Q1
2N264
IF AMPL
Q2
2N264
IF AMPL
Q3
2N264
AGC
J2
CR1
1N457
CR2
HD2 60
PART OF P
PART OF J9
A
B
C
D
E
F
G
H
J
K
L
M
N
P
Q
R
S
T
U
V
W
X

Figure 5-105. Converter-Oscillator CV-731/URC, Stabilized Master Oscillator Module (SMO), Model A, Schematic Diagram (Sheet 2 of 2)

NOTES

1. UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES IN UUF, AND ALL INDUCTANCE VALUES IN UH.
2. FINAL VALUE DETERMINED BY PRODUCTION TESTS.
3. FL1, A3FL1, AND A6FL1 ARE NON-REPAIRABLE ITEMS. COMPONENTS SHOWN ARE REPRESENTATIVE ONLY
4. DC RESISTANCE OF ALL COILS LESS THAN ONE OHM HAS BEEN OMITTED
5. FOR DESTINATION OF INPUTS AND OUTPUTS OF P1, SEE FREQUENCY GENERATOR 786E-1 CHASSIS SCHEMATIC DIAGRAM.
6. REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATIONS WITH UNIT NUMBER AND SUBASSEMBLY DESIGNATION
7. ALL RESISTANCE AND VOLTAGE MEASUREMENTS TAKEN WITH VTVM TO GROUND. RESISTANCE MEASUREMENTS TAKEN WITH ALL SUBASSEMBLIES PLUGGED IN AND SMO UNPLUGGED FROM CHASSIS. VOLTAGE MEASUREMENTS TAKEN WITH UNIT PLUGGED INTO CHASSIS OR CONNECTED BY PENDANT CABLES MEASUREMENTS NOT GIVEN ON MASTER OSCILLATOR, SINCE SUBASSEMBLY IS A SEALED UNIT. NC IN TABLE MEANS NOT CONNECTED. BE CAREFUL IN MEASURING RESISTANCE AT TRANSISTOR TERMINALS TO OBSERVE PROPER POLARITY AND TO USE HIGHEST METER RANGE PRACTICABLE TO AVOID EXCESSIVE BASE CURRENT IN THE TRANSISTORS BE SURE TO GROUND THE COMMON LEAD OF THE VTVM WHEN MAKING RESISTANCE MEASUREMENTS ON TRANSISTORS

REF DES		PIN NUMBERS								
		1	2	3	4	5	6	7	8	9
V1	V	-13V	0	0	6.3VAC	130V	32V	0		
	R	11MEG	0	0	0.2	75K	15K	0		
V2	V	0	2.25V	0	6 3VAC	128V	82V	0		
	R	0	330	0	0.2	65K	72K	48K		
V3	V	-1.7V	0	0	6 3VAC	11V	50V	0		
	R	10K	0	0	0.2	110K	90K	0		
V4	V	6 3VAC	6V	1.7V	54V	NC	62V	5 8V	6 4V	0
	R	0.2	2K	300	110K	NC	95K	48K	2K	0
A3V1	V	0	NC	6.3VAC	0	86V	0	86V	2 1V	
	R	15	NC	1	14	75K	0	75K	560	
A3V2	V	0	NC	0	0	84V	6 3VAC	84V	2 2V	
	R	4	NC	0	22K	75K	0.2	75K	560	
A5V1	V	8VAC -8V	1VAC	0	1VAC	80V 25VAC	6 3VAC	53V	1VAC	
	R	00K	0 5	0	0 5	80K	5	80K	0 5	
A6V1	V	0	2 1V	0	-0.1V	89V	6 3VAC	89V	NC	
	R	4	520	0.2	22K	75K	1	75K	NC	
A8V1	V	110V	16V	0	16V	16V	6 3VAC	16V	110V	
	R	0	0	0	1680	1680	15	0	0	

REF DES		PIN DESIGNATION		
		E	C	B
A2Q3	V	13 5V	26V	15V
	R	5K	K	2K
A2Q4	V	15 5V	15V	2 1V
	R	1200	7500	750
A2Q5	V	0 02V	25V	0 43V
	R	200	13K	13K
A2Q6	V	0 01V	24 5V	0 42V
	R	200	12 5K	13K
A6Q	V	0	2V	0 23V
	R	0	1.2K	450
A6Q2	V	2 2V	2 8V	2 7V
	R	2200	12K	8500
A6Q3	V	11V	15V	1 65V
	R	2200	2 5K	9800
A7Q1	V	0 0 V	26V	0 45V
	R	200	12K	3 5K
A7Q2	V	7V	17V	2 4V
	R	1500	8K	1400
A7Q3	V	6V	26V	7V
	R	7K	1100	7500

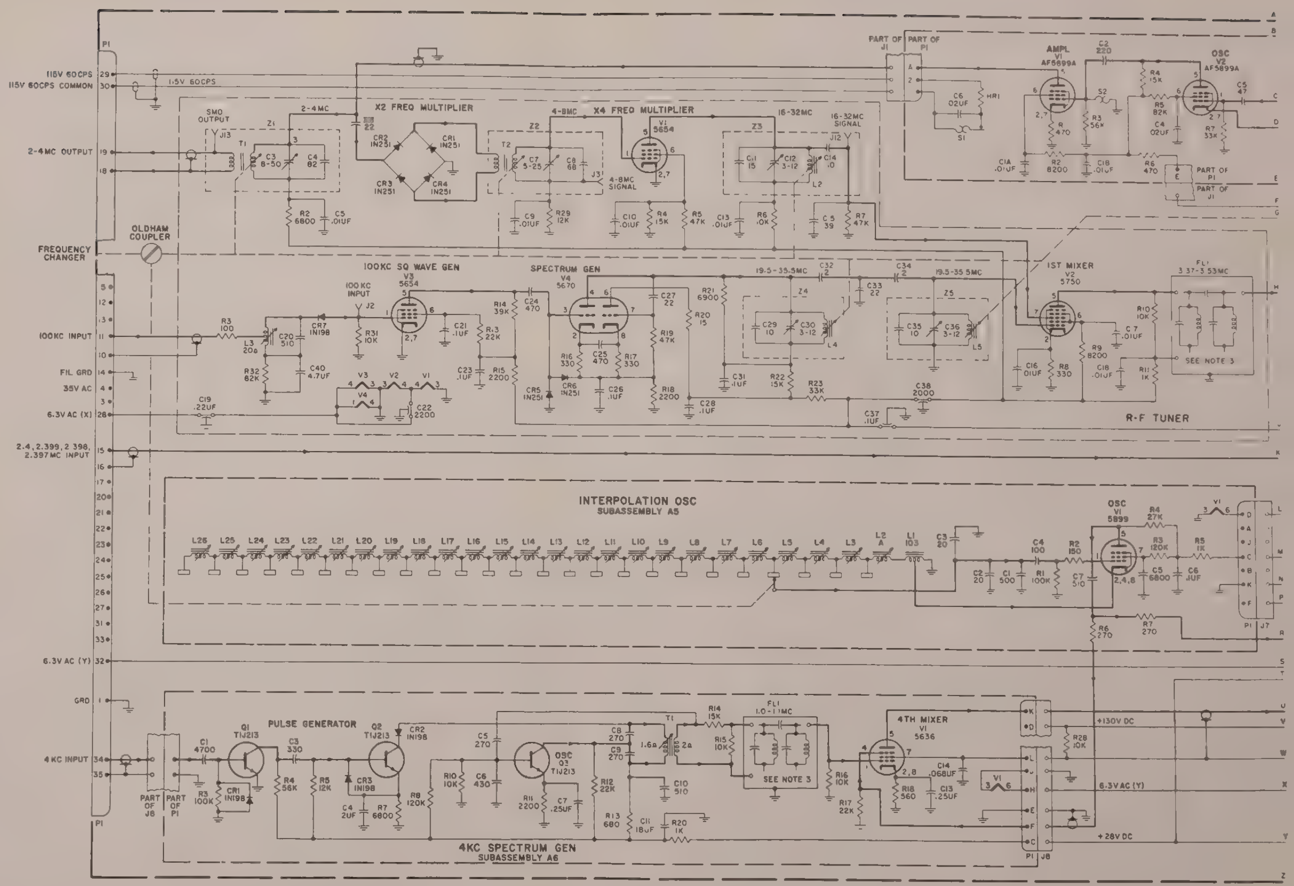

P1
115V 60CPS
115V 60CPS COMMON
1.5V 60CPS
SMO OUTPUT
J13
2-4MC OUTPUT
2-4MC
X2 FREQ MULTIPLIER
4-8MC
X4 FREQ MULTIPLIER
16-32MC
16-32MC SIGNAL
4-8MC SIGNAL
PART OF J1
PART OF P1
AMPL V1 AF5899A
OSC V2 AF5899A
FREQUENCY CHANGER
OLDHAM COUPLER
100KC SQ WAVE GEN
SPECTRUM GEN
100KC INPUT
FIL GRD
35V AC
6.3V AC (X)
19.5-35.5MC
1ST MIXER
FL1 3.37-3.53MC
SEE NOTE 3
R-F TUNER
2.4, 2.399, 2.398, 2.397MC INPUT
INTERPOLATION OSC
SUBASSEMBLY A5
OSC V1 5899
6.3V AC (Y)
GRD
PULSE GENERATOR
4KC INPUT
PART OF J8
PART OF P1
FL1 1.0-1.1MC
SEE NOTE 3
4TH MIXER V1 5636
+130V DC
6.3V AC (Y)
+28V DC
4KC SPECTRUM GEN
SUBASSEMBLY A6
P1 J8
A
B
C
D
E
F
G
H
J
K
L
M
N
P
R
S
T
U
V
W
X
Y
Z

Figure 5-106. Converter-Oscillator CV-731/URC, Stabilized Master Oscillator (SMO), Model B, Schematic Diagram (Sheet 1 of 2)

NOTES

1. UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES IN UUF, AND ALL INDUCTANCE VALUES IN UH
2. FINAL VALUE DETERMINED BY PRODUCTION TESTS
3. FL1, A3FL1, AND A6FL1 ARE NON-REPAIRABLE ITEMS COMPONENTS SHOWN ARE REPRESENTATIVE ONLY
4. DC RESISTANCE OF ALL COILS LESS THAN ONE OHM HAS BEEN OMITTED
5. FOR DESTINATION OF INPUTS AND OUTPUTS OF P1, SEE FREQUENCY GENERATOR 786E-1 CHASSIS SCHEMATIC DIAGRAM
6. REFERENCE DESIGNATIONS ARE ABBREVIATED, PREFIX THE DESIGNATIONS WITH UNIT NUMBER AND SUBASSEMBLY DESIGNATION
7. ALL RESISTANCE AND VOLTAGE MEASUREMENTS TAKEN WITH VTVM TO GROUND RESISTANCE MEASUREMENTS TAKEN WITH ALL SUBASSEMBLIES PLUGGED IN AND SMO UNPLUGGED FROM CHASSIS VOLTAGE MEASUREMENTS TAKEN WITH UNIT PLUGGED INTO CHASSIS OR CONNECTED BY PENDANT CABLES MEASUREMENTS NOT GIVEN ON MASTER OSCILLATOR, SINCE SUBASSEMBLY IS A SEALED UNIT NC IN TABLE MEANS NOT CONNECTED. BE CAREFUL IN MEASURING RESISTANCE AT TRANSISTOR TERMINALS TO OBSERVE PROPER POLARITY AND TO USE HIGHEST METER RANGE PRACTICABLE TO AVOID EXCESSIVE BASE CURRENT IN THE TRANSISTORS BE SURE TO GROUND THE COMMON LEAD OF THE VTVM WHEN MAKING RESISTANCE MEASUREMENTS ON TRANSISTORS

REF DES		PIN NUMBERS								
		1	2	3	4	5	6	7	8	9
V1	V	3V	0	0	6.3VAC	130V	32V	0		
	R	1MEG	0	0	02	75K	15K	0		
V2	V	0	2.25V	0	6.3VAC	128V	82V	0		
	R	0	330	0	02	65K	72K	48K		
V3	V	17V	0	0	6.3VAC	1V	50V	0		
	R	10K	0	0	02	OK	90K	0		
[illegible]	V	6.3VAC	6V	17V	54V	NC	62V	5.8V	6.4V	0
	R	02	2K	300	1.0K	NC	95K	48K	2K	0
A3V1	V	0	NC	6.3VAC	0	86V	0	86V	2.1V	
	R	5	NC	1	4	[illegible]		75K	560	
A3V2	V	0	NC	0	0	94V	6.3VAC	84V	2.2V	
	R	4	NC	0	22K	75K	02	75K	560	
A5V1	V	8VAC 8V	VAC	0	1VAC	80V 25VAC	6.3VAC	53V	1VAC	
	R	00K	0.5	0	0.5	90K	5	190K	0.5	
A6V1	V	0	2 V	0	-0.1V	89V	6.3VAC	89V	NC	
	R	4	520	02	22K	75K	1	75K	NC	
A8V1	V	1.0V	16V	0	16V	16V	6.3VAC	16V	110V	
	R	0	0	0	1680	1680	15	0	0	

REF DES		PIN DESIGNATION		
		E	C	B
A2Q3	V	13.5V	26V	15V
	R	5K	1K	2K
A2Q4	V	15.5V	15V	2.1V
	R	1200	7500	750
A2Q5	V	0.02V	25V	0.43V
	R	200	13K	13K
A2Q6	V	0.01V	24.5V	0.42V
	R	200	12.5K	13K
A6Q1	V	0	12V	0.23V
	R	0	12K	450
A6Q2	V	2.2V	2.8V	2.7V
	R	2200	12K	8500
A6Q3	V	[illegible]	15V	1.65V
	R	2200	12.5K	9800
A7Q1	V	0.01V	26V	0.45V
	R	200	12K	13.5K
A7Q2	V	17V	17V	2.4V
	R	1500	8K	1400
A7Q3	V	16V	26V	17V
	R	7K	1100	7500

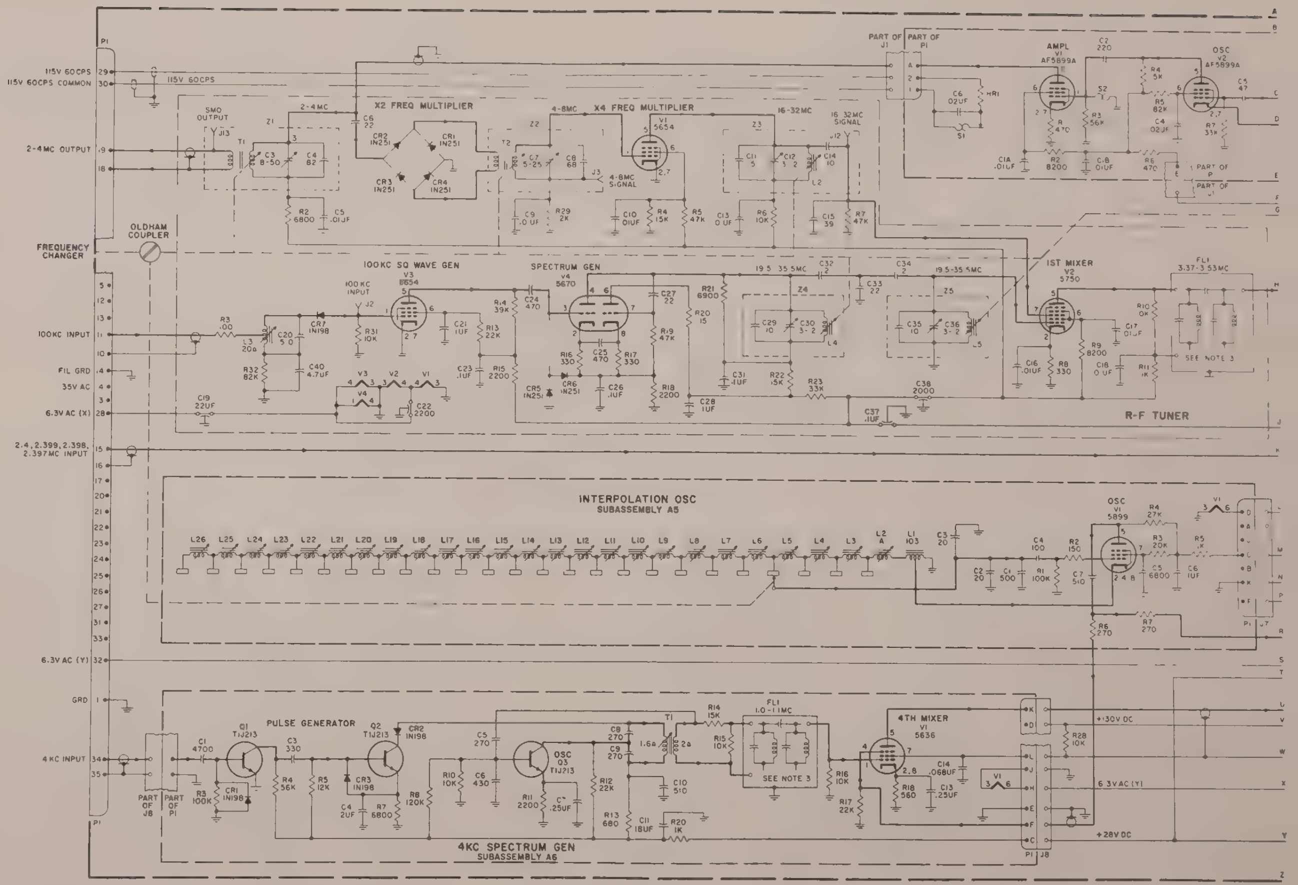

P1
115V 60CPS
115V 60CPS COMMON
2-4MC OUTPUT
FREQUENCY CHANGER
OLDHAM COUPLER
100KC INPUT
FIL GRD
35V AC
6.3V AC (X)
2.4, 2.399, 2.398, 2.397MC INPUT
6.3V AC (Y)
GRD
4KC INPUT
SMO OUTPUT
J13
2-4MC
X2 FREQ MULTIPLIER
4-8MC
X4 FREQ MULTIPLIER
16-32MC
16 32MC SIGNAL
4-8MC SIGNAL
PART OF J1
PART OF P1
AMPL
OSC
100KC SQ WAVE GEN
100KC INPUT
SPECTRUM GEN
19.5 35.5MC
IST MIXER
FL1 3.37-3.53MC
SEE NOTE 3
R-F TUNER
INTERPOLATION OSC
SUBASSEMBLY A5
PULSE GENERATOR
4TH MIXER
4KC SPECTRUM GEN
SUBASSEMBLY A6
+130V DC
6.3VAC (Y)
+28V DC
PART OF J8
PART OF P1

Figure 5-106. Converter-Oscillator CV-731/URC, Stabilized Master Oscillator (SMO), Model B, Schematic Diagram (Sheet 1 of 2)

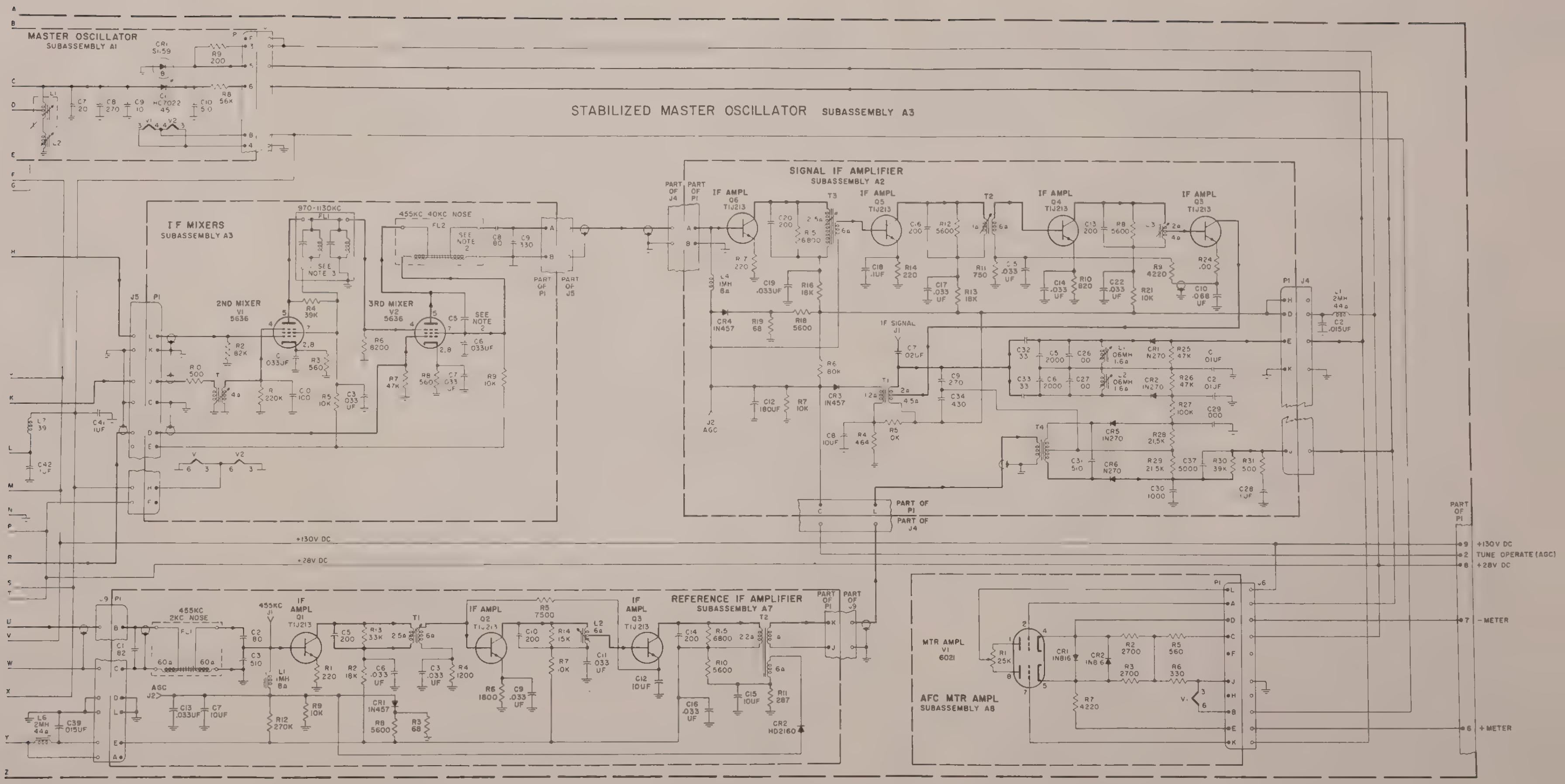

MASTER OSCILLATOR
SUBASSEMBLY A1
STABILIZED MASTER OSCILLATOR SUBASSEMBLY A3
SIGNAL IF AMPLIFIER
SUBASSEMBLY A2
IF MIXERS
SUBASSEMBLY A3
2ND MIXER
V1
5636
3RD MIXER
V2
5636
970-1130KC
FL1
455KC 40KC NOSE
FL2
SEE NOTE 2
SEE NOTE 3
IF AMPL
Q6
TIJ213
IF AMPL
Q5
TIJ213
IF AMPL
Q4
TIJ213
IF AMPL
Q3
TIJ213
IF SIGNAL
J1
J2
AGC
PART OF P1
PART OF J4
PART OF J5
+130V DC
+28V DC
REFERENCE IF AMPLIFIER
SUBASSEMBLY A7
455KC
2KC NOSE
IF AMPL
Q1
TIJ213
IF AMPL
Q2
TIJ213
IF AMPL
Q3
TIJ213
MTR AMPL
V1
6021
AFC MTR AMPL
SUBASSEMBLY A8
+130V DC
TUNE OPERATE (AGC)
+28V DC
-METER
+METER
A
B
C
D
E
F
G
H
J
K
L
M
N
P
R
S
T
U
V
W
X
Y
Z

Figure 5-106. Converter-Oscillator CV-731/URC, Stabilized Master Oscillator (SMO), Model B, Schematic Diagram (Sheet 2 of 2)

PART LOCATION INDEX

REF DESIG	LOC
Chassis	
C2	29D
C39	14I
C41	15F
C42	14F
R28	11H
L1	29D
L6	14I
L7	14F
R-F Tuner	
C3	3-B
C4	3-B
C5	4-C
C6	4-B
C7	6-B
C8	6-B
C9	6-C
C10	7-C
C11	8-B
C12	8-B
C13	8-C
C14	9-B
C15	9-C
C16	11-D
C17	11-D
C18	11-D
C19	2-E
C20	3-D
C21	5-D
C22	5-E
C23	5-D
C24	6-D
C25	6-D
C26	6-E
C27	7-D
C28	7-E
C29	8-D
C30	8-D
C31	8-D
C32	8-C
C33	9-D
C34	9-C
C35	9-D
C36	10-D
C37	9-E
C38	9-E
C40	3-D
CR1	5-B
CR2	4-B
CR3	4-C
CR4	4-D
CR5	6-E
CR6	6-E
CR7	4-D
FL1	12D
J2	4D
J12	9B
J13	3B
L1	
L2	8-C
L3	3-D
L4	9-D
L5	10-D
R1	
R2	3-C
R3	3-D
R4	7-C
R5	7-C
R6	8-C
R7	9-C
R8	11-D
R9	11-D
R10	12-D
R11	12-D
R12	
R13	5-D
R14	5-D
R15	5-D
R16	6-D
R17	7-D
R18	7-E
R19	7-D
R20	7-D
R21	7-D
R22	8-D
R23	8-E
R24	
R25	
R29	6-C
T1	3-B
T2	5-B
V1	7-B
V2	11-D
V3	4-D
V4	6-D
Z1	3-B
Z2	6-B
Z3	8-B
Z4	8-D
Z5	10-D
Master Oscillator	
A1C1	11-B
A1C2	11-A
A1C3	12-B
A1C4	12-B
A1C5	13-B
A1C6	10-B
A1C7	14-B
A1C8	15-B
A1C9	15-B
A1C10	16-B
A1C11	15-B
A1CR1	15A
A1HR1	10B
A1L1	14B
A1L2	14B
A1R1	11-B
A1R2	11-B
A1R3	11-B
A1R4	12-A
A1R5	12-B
A1R6	12-B
A1R7	12-B
A1R8	16-B
A1R9	16-A
A1S1	10B
A1S2	11B
A1V1	11B
A1V2	12B
Signal I-F Amplifier	
A2C1	27-E
A2C2	27-E
A2C3	
A2C4	
A2C5	25-E
A2C6	25-E
A2C7	24-E
A2C8	23-F
A2C9	24-E
A2C10	27-D
A2C11	
A2C12	22-E
A2C13	26-C
A2C14	25-D
A2C15	25-D
A2C16	24-C
A2C17	24-D
A2C18	23-D
A2C19	22-D
A2C20	22-C
A2C21	
A2C22	26-D
A2C23	
A2C24	
A2C25	
A2C26	26-E
A2C27	26-E
A2C28	28-F
A2C29	27-E
A2C30	27-F
A2C31	26-F
A2C32	25-E
A2C33	25-E
A2C34	24-E
A2C35	
A2C36	
A2C37	27-F
A2CR1	26-E
A2CR2	26-E
A2CR3	23-E
A2CR4	22-D
A2CR5	26-F
A2CR6	26-F
A2J1	24-D
A2J2	21-F
A2L1	26-E
A2L2	26-E
A2L3	26-C
A2L4	22-D
A2Q3	27-C
A2Q4	25-C
A2Q5	23-C
A2Q6	22-C
A2R4	23-F
A2R5	23-F
A2R6	23-E
A2R7	22-E
A2R8	26-C
A2R9	27-D
A2R10	26-D
A2R11	25-D
A2R12	24-C
A2R13	24-D
A2R14	24-D
A2R15	23-C
A2R16	23-D
A2R17	22-D
A2R18	22-D
A2R19	22-D
A2R20	
A2R21	26-D
A2R22	
A2R23	
A2R24	27-D
A2R25	27-E
A2R26	27-E
A2R27	27-E
A2R28	27-F
A2R29	27-F
A2R30	27-F
A2R31	28-F
A2T1	23-E
A2T2	25-C
A2T3	23-C
A2T4	25-F
I-F Mixers	
A3C1	17-E
A3C2	Not Used
A3C3	17-E
A3C4	Not Used
A3C5	Not Used
A3C6	19-E
A3C7	19-E
A3C8	19-C
A3C9	Not Used
A3C10	17-E
A3C11	19-D
A3FL1	17C
A3R1	17-E
A3R2	16-E
A3R3	17-E
A3R4	17-D
A3R5	17-E
A3R6	18-E
A3R7	18-E
A3R8	18-E
A3R9	19-E
A3R10	19-D
A3R11	16-E
A3T1	16E
A3V1	16D
A3V2	18D
Interpolation Oscillator	
A5C1	10-F
A5C2	10-F
A5C3	10-F
A5C4	11-F
A5C5	12-F
A5C6	12-F
A5C7	11-F
A5L1	9-F
A5L2	9-F
A5L3	9-F
A5L4	8-F
A5L5	8-F
A5L6	8-F
A5L7	8-F
A5L8	7-F
A5L9	7-F
A5L10	7-F
A5L11	6-F
A5L12	6-F
A5L13	6-F
A5L14	6-F
A5L15	5-F
A5L16	5-F
A5L17	5-F
A5L18	4-F
A5L19	4-F
A5L20	4-F
A5L21	4-F
A5L22	3-F
A5L23	3-F
A5L24	3-F
A5L25	3-F
A5L26	2-F
A5P1	13G
A5R1	11-F
A5R2	11-F
A5R3	12-F
A5R4	12-F
A5R5	12-F
A5R6	11-G
A5R7	12-G
A5V1	11F
4-Kc Spectrum Generator	
A6C1	2-H
A6C2	Not Used
A6C3	3-H
A6C4	4-I
A6C5	5-H
A6C6	5-H
A6C7	6-I
A6C8	6-H
A6C9	6-H
A6C10	7-H
A6C11	7-I
A6C12	Not Used
A6C13	10-H
A6C14	10-H
A6CR1	3I
A6CR2	4H
A6CR3	4H
A6FL1	8H
A6P1	10I
A6Q1	3H
A6Q2	4H
A6Q3	6H
A6R1	Not Used
A6R2	Not Used
A6R3	2-I
A6R4	3-H
A6R5	4-H
A6R6	Not Used
A6R7	4-I
A6R8	4-I
A6R9	Not Used
A6R10	5-H
A6R11	6-I
A6R12	6-H
A6R13	6-I
A6R14	7-H
A6R15	7-H
A6R16	9-H
A6R17	9-I
A6R18	9-H
A6R19	Not Used
A6R20	7-I
Reference I-F Amplifier	
A7C1	15-H
A7C2	16-H
A7C3	16-H
A7C4	Not Used
A7C5	17-H
A7C6	18-H
A7C7	16-I
A7C8	Not Used
A7C9	19-H
A7C10	19-H
A7C11	20-H
A7C12	21-H
A7C13	16-I
A7C14	21-H
A7C15	22-I
A7C16	21-I
A7CR1	18I
A7CR2	22I
A7J1	17H
A7J2	15I
A7L1	17H
A7L2	20H
A7Q1	17H
A7Q2	19H
A7Q3	21H
A7R1	17-H
A7R2	17-H
A7R3	18-I
A7R4	19-H
A7R5	20-H
A7R6	19-H
A7R7	20-H
A7R8	18-I
A7R9	17-I
A7R10	21-H
A7R11	22-I
A7R12	17-I
A7R13	18-H
A7R14	20-H
A7R15	21-H
A7T1	18H
A7T2	22H
AFC Meter Amplifier	
A8CR1	25H
A8CR2	26H
A8R1	25-H
A8R2	26-H
A8R3	26-H
A8R4	Not Used
A8R5	27-H
A8R6	27-H
A8R7	26-I
A8V1	25-H

NOTES:

1. UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES IN UUF, AND ALL INDUCTANCE VALUES IN UH
2. FINAL VALUE DETERMINED BY PRODUCTION TESTS
3. FL1, A3FL1, A3FL2, AND A6FL1 ARE NON-REPAIRABLE ITEMS. COMPONENTS SHOWN ARE REPRESENTATIVE ONLY
4. DC RESISTANCE OF ALL COILS LESS THAN ONE OHM HAS BEEN OMITTED
5. FOR DESTINATION OF INPUTS AND OUTPUTS OF P1, SEE FREQUENCY GENERATOR 786E-1 CHASSIS SCHEMATIC DIAGRAM
6. REFERENCE DESIGNATIONS ARE ABBREVIATED, PREFIX THE DESIGNATIONS WITH UNIT NUMBER AND SUBASSEMBLY DESIGNATION
7. ALL RESISTANCE AND VOLTAGE MEASUREMENTS TAKEN WITH VTVM TO GROUND. RESISTANCE MEASUREMENTS TAKEN WITH ALL SUBASSEMBLIES PLUGGED IN AND SMO UNPLUGGED FROM CHASSIS. VOLTAGE MEASUREMENTS TAKEN WITH UNIT PLUGGED INTO CHASSIS OR CONNECTED BY PENDANT CABLES. MEASUREMENTS NOT GIVEN ON MASTER OSCILLATOR, SINCE SUBASSEMBLY IS A SEALED UNIT. NC IN TABLE MEANS NOT CONNECTED. BE CAREFUL IN MEASURING RESISTANCE AT TRANSISTOR TERMINALS TO OBSERVE PROPER POLARITY AND TO USE HIGHEST METER RANGE PRACTICABLE TO AVOID EXCESSIVE BASE CURRENT IN THE TRANSISTORS. BE SURE TO GROUND THE COMMON LEAD OF THE VTVM WHEN MAKING RESISTANCE MEASUREMENTS ON TRANSISTORS

REF DES		PIN NUMBERS								
		1	2	3	4	5	6	7	8	9
V1	V	-13V	0	0	6.3VAC	130V	32V	0		
	R	1.1MEG	0	0	0.2	75K	5K	0		
V2	V	0	2.25V	0	6.3VAC	128V	82V	0		
	R	0	330	0	0.2	65K	72K	48K		
V3	V	17V	0	0	6.3VAC	11V	50V	0		
	R	10K	0	0	0.2	110K	90K	0		
V4	V	6.3VAC	6V	17V	54V	NC	62V	5.8V	6.4V	0
	R	0.2	2K	300	0K	NC	95K	48K	2K	0
A3V1	V	0	NC	6.3VAC	0	86V	0	86V	2.1V	
	R	15	NC	1	14	75K	0	74K	560	
A3V2	V	0	NC	0	0	84V	6.3VAC	84V	2.2V	
	R	4	NC	0	22K	75K	0.2	75K	560	
A5V1	V	8VAC -8V	1VAC	0	1VAC	80V 25VAC	6.3VAC	53V	1VAC	
	R	100K	0.5	0	0.5	90K	5	180K	0.5	
A6V1	V	0	2.1V	0	-0.1V	89V	6.3VAC	89V	NC	
	R	4	520	0.2	22K	75K	1	75K	NC	
A8V1	V	110V	16V	0	16V	16V	6.3VAC	16V	10V	
	R	0	0	0	1680	1680	15	0	0	

REF DES		PIN DESIGNATION		
		E	C	B
A2Q3	V	13.5V	28V	15V
	R	5K	1K	2K
A2Q4	V	5.5V	15V	2.1V
	R	1200	7500	750
A2Q5	V	0.02V	25V	0.43V
	R	200	13K	13K
A2Q6	V	0.01V	24.5V	0.42V
	R	200	12.5K	13K
A6Q1	V	0	2V	0.23V
	R	0	12K	450
A6Q2	V	2.2V	2.8V	2.7V
	R	2200	12K	8500
A6Q3	V	11V	15V	6.5V
	R	2200	12.5K	9600
A7Q1	V	0.0V	26V	0.45V
	R	200	2K	3.5K
A7Q2	V	1.7V	7V	2.4V
	R	500	8K	1400
A7Q3	V	6V	26V	7V
	R	7K	1100	7500

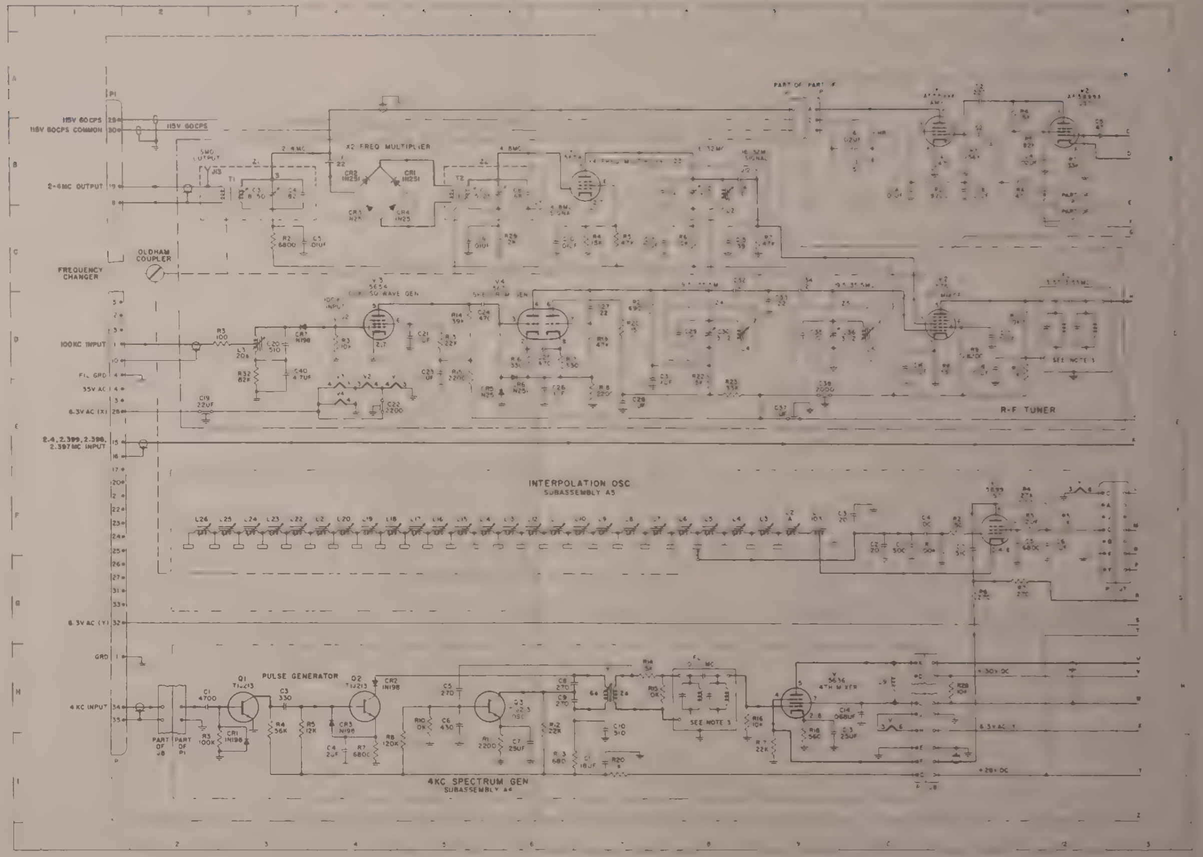


Figure 5-107. Converter-Oscillator CV-731/URC, Stabilized Master Oscillator (SMO), Model C, Schematic Diagram (Sheet 1 of 2)

NOTES:

1. UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES IN UUF, AND ALL INDUCTANCE VALUES IN UH.
2. FINAL VALUE DETERMINED BY PRODUCTION TESTS.
3. FL1, A3FL1, A3FL2, AND A6FL ARE NON-REPAIRABLE ITEMS, COMPONENTS SHOWN ARE REPRESENTATIVE ONLY.
4. DC RESISTANCE OF ALL COILS LESS THAN ONE OHM HAS BEEN OMITTED
5. FOR DESTINATION OF INPUTS AND OUTPUTS OF P1, SEE FREQUENCY GENERATOR 786E-1 CHASSIS SCHEMATIC DIAGRAM.
6. REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATIONS WITH UNIT NUMBER AND SUBASSEMBLY DESIGNATION.
7. ALL RESISTANCE AND VOLTAGE MEASUREMENTS TAKEN WITH VTVM TO GROUND RESISTANCE MEASUREMENTS TAKEN WITH ALL SUBASSEMBLIES PLUGGED IN AND SMO UNPLUGGED FROM CHASSIS. VOLTAGE MEASUREMENTS TAKEN WITH UNIT PLUGGED INTO CHASSIS OR CONNECTED BY PENDANT CABLES MEASUREMENTS NOT GIVEN ON MASTER OSCILLATOR, SINCE SUBASSEMBLY IS A SEALED UNIT NC IN TABLE MEANS NOT CONNECTED BE CAREFUL IN MEASURING RESISTANCE AT TRANSISTOR TERMINALS TO OBSERVE PROPER POLARITY AND TO USE HIGHEST METER RANGE PRACTICABLE TO AVOID EXCESSIVE BASE CURRENT IN THE TRANSISTORS BE SURE TO GROUND THE COMMON LEAD OF THE VTVM WHEN MAKING RESISTANCE MEASUREMENTS ON TRANSISTORS.

REF DES		PIN NUMBERS								
		1	2	3	4	5	6	7	8	9
V1	V	-13V	0	0	6.3VAC	130V	32V	0		
	R	11MEG	0	0	0.2	75K	15K	0		
V2	V	0	2.25V	0	6.3VAC	28V	82V	0		
	R	0	330	0	0.2	65K	72K	48K		
V3	V	17V	0	0	6.3VAC	V	50V	0		
	R	10K	0	0	0.2	.0K	90K	0		
V4	V	6.3VAC	6V	17V	34V	NC	62V	5.8V	6.4V	0
	R	0.2	2K	300	10K	NC	95K	48K	2K	0
A3V1	V	0	NC	6.3VAC	0	86V	0	86V	2.1V	
	R	1.5	NC	1	1.4	75K	0	75K	560	
A3V2	V	0	NC	0	0	84V	6.3VAC	84V	2.2V	
	R	4	NC	0	22K	75K	0.2	75K	560	
A5V1	V	8VAC -8V	1VAC	0	1VAC	80V 25VAC	6.3VAC	53V	1VAC	
	R	100K	0.5	0	0.5	90K	5	80K	0.5	
A6V1	V	0	2.1V	0	0.1V	89V	6.3VAC	89V	NC	
	R	4	520	0.2	22K	75K	1	75K	NC	
A8V1	V	110V	16V	0	16V	6V	6.3VAC	16V	110V	
	R	0	0	0	1680	1680	15	0	0	

REF DES		PIN DESIGNATION		
		E	C	B
A2Q3	V	13.5V	26V	15V
	R	5K	1K	2K
A2Q4	V	5.5V	15V	2.1V
	R	1200	7500	750
A2Q5	V	0.02V	25V	0.43V
	R	200	13K	3K
A2Q6	V	0.01V	24.5V	0.42V
	R	200	2.5K	13K
A6Q1	V	0	12V	0.25V
	R	0	12K	450
A6Q2	V	2.2V	2.8V	2.7V
	R	2200	12K	8500
A6Q3	V	V	15V	1.65V
	R	2200	2.5K	9800
A7Q1	V	0.01V	26V	0.45V
	R	200	2K	13.5K
A7Q2	V	7V	17V	2.4V
	R	1500	8K	1400
A7Q3	V	6V	26V	7V
	R	7K	1100	7500

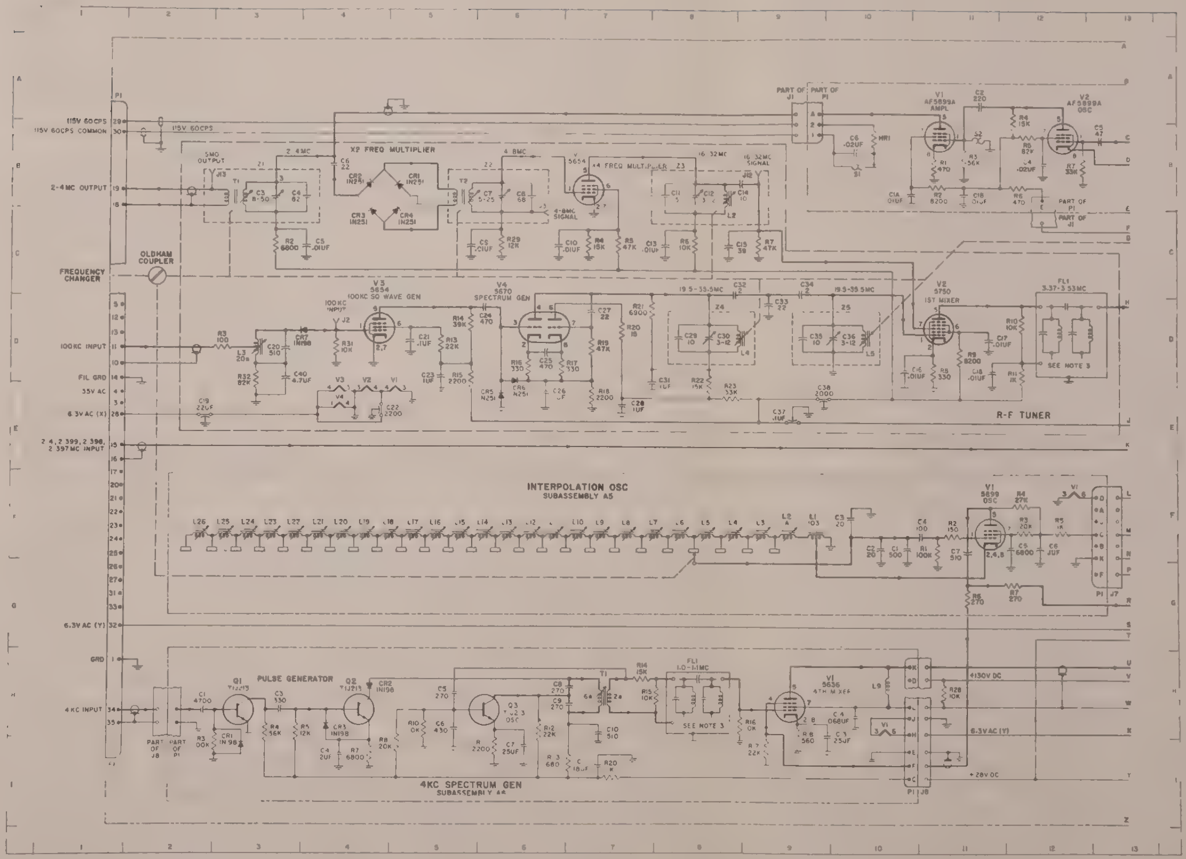


Figure 5-107. Converter-Oscillator CV-731/URC, Stabilized Master Oscillator (SMO), Model C, Schematic Diagram (Sheet 1 of 2)

REF DESIG	LOC	REF DESIG	LOC	REF DESIG	LOC	REF DESIG	LOC	REF DESIG	LOC	REF DESIG	LOC	REF DESIG	LOC
Chassis		J12	9B	A1HR1	10B	A2CR3	23-E	A3C10	17-E	A5R5	12-F	A7C6	18-H
		J13	3B	A1L1	14B	A2CR4	22-D	A3C11	19-D	A5R6	11-G	A7C7	18-I
C2	29D	L1		A1L2	14B	A2CR5	26-F	A3FL1	[illegible]	A5R7	12-G	A7C8	Not Used
C39	14I	L2	8-C	A1R1	11-B	A2CR6	26-F	A3R1	17-E	A5V1	11F	A7C9	19-H
C41	15F	L3	3-D	A1R2	11-B	A2J1	24-D	A3R2	16-F			A7C10	19-H
C42	14F	L4	9-D	A1R3	11-B	A2J2	21-F	A3R3	17-F	4-KC Spectrum		A7C11	20-H
R28	11H	L5	10-D	A1R4	12-A	A2L1	26-E	A3R4	17-D	Generator		A7C12	21-H
L1	29D	R1		A1R5	12-B	A2L2	26-E	A3R5	17-F			A7C13	16-I
L6	14I	R2	3-C	A1R6	12-B	A2L3	26-C	A3R6	18-E	A6C1	2-H	A7C14	21-H
L7	14F	R3	3-D	A1R7	12-B	A2L4	22-D	A3R7	18-F	A6C2	Not Used	A7C15	22-I
		R4	7-C	A1R8	16-B	A2Q3	27-C	A3R8	18-E	A6C3	3-H	A7C16	21-I
R-F Tuner		R5	7-C	A1R9	16-A	A2Q4	25-C	A3R9	19-E	A6C4	4-I	A7CR1	16I
		R6	8-C	A1S1	10B	A2Q5	23-C	A3R10	19-D	A6C5	5-H	A7CR2	22I
C3	3-B	R7	9-C	A1S2	11B	A2Q6	22-C	A3R11	16-E	A6C6	5-H	A7J1	17H
C4	3-B	R8	11-D	A1V1	11B	A2R4	23-F	A3T1	16E	A6C7	6-I	A7J2	15I
C5	4-C	R9	11-D	A1V2	12B	A2R5	23-F	A3V1	16D	A6C8	6-H	A7L1	17H
C6	4-B	R10	12-D			A2R6	23-E	A3V2	18D	A6C9	6-H	A7L2	20H
C7	6-B	R11	12-D	Signal I-F		A2R7	22-E			A6C10	7-H	A7Q1	17H
C8	6-B	R12		Amplifier		A2R8	26-C	Interpolation		A6C11	7-I	A7Q2	19H
C9	6-C	R13	5-D			A2R9	27-D	Oscillator		A6C12	Not Used	A7Q3	21H
C10	7-C	R14	5-D	A2C1	27-E	A2R10	26-D			A6C13	10-H	A7R1	17-H
C11	8-B	R15	5-D	A2C2	27-E	A2R11	25-D	A5C1	10-F	A6C14	10-H	A7R2	17-H
C12	8-B	R16	6-D	A2C3		A2R12	24-C	A5C2	10-F	A6CR1	3I	A7R3	18-I
C13	8-C	R17	7-D	A2C4		A2R13	24-D	A5C3	10-F	A6CR2	4H	A7R4	19-H
C14	9-B	R18	7-E	A2C5	25-E	A2R14	24-D	A5C4	11-F	A6CR3	4H	A7R5	20-H
C15	9-C	R19	7-D	A2C6	25-E	A2R15	23-C	A5C5	12-F	A6FL1	8H	A7R6	19-H
C16	11-D	R20	7-D	A2C7	24-E	A2R16	23-D	A5C6	12-F	A6P1	10I	A7R7	20-H
C17	11-D	R21	7-D	A2C8	23-F	A2R17	22-D	A5C7	11-F	A6Q1	3H	A7R8	16-I
C18	11-D	R22	8-D	A2C9	24-E	A2R18	22-D	A5L1	9-F	A6Q2	4H	A7R9	17-I
C19	2-E	R23	8-E	A2C10	27-D	A2R19	22-D	A5L2	9-F	A6Q3	6H	A7R10	21-H
C20	3-D	R24		A2C11		A2R20		A5L3	9-F	A6R1	Not Used	A7R11	22-I
C21	5-D	R25		A2C12	22-E	A2R21	26-D	A5L4	8-F	A6R2	Not Used	A7R12	17-I
C22	5-E	R29	6-C	A2C13	26-C	A2R22		A5L5	8-F	A6R3	2-I	A7R13	18-H
C23	5-D	T1	3-B	A2C14	25-D	A2R23		A5L6	8-F	A6R4	3-H	A7R14	20-H
C24	6-D	T2	5-B	A2C15	25-D	A2R24	27-D	A5L7	8-F	A6R5	4-H	A7R15	21-H
C25	6-D	V1	7-B	A2C16	24-C	A2R25	27-E	A5L8	7-F	A6R6	Not Used	A7T1	18H
C26	6-E	V2	11-D	A2C17	24-D	A2R26	27-E	A5L9	7-F	A6R7	4-I	A7T2	22H
C27	7-D	V3	4-D	A2C18	23-D	A2R27	27-E	A5L10	7-F	A6R8	4-I		
C28	7-E	V4	6-D	A2C19	22-D	A2R28	27-F	A5L11	6-F	A6R9	Not Used	AFC Meter	
C29	8-D	Z1	3-B	A2C20	22-C	A2R29	27-F	A5L12	6-F	A6R10	5-H	Amplifier	
C30	8-D	Z2	6-B	A2C21		A2R30	27-F	A5L13	6-F	A6R11	6-I		
C31	8-D	Z3	8-B	A2C22	26-D	A2R31	26-F	A5L14	6-F	A6R12	6-H	A8CR1	25H
C32	8-C	Z4	8-D	A2C23		A2T1	23-E	A5L15	5-F	A6R13	6-I	A8CR2	26H
C33	9-D	Z5	10-D	A2C24		A2T2	25-C	A5L16	5-F	A6R14	7-H	A8R1	25-H
C34	9-C			A2C25		A2T3	23-C	A5L17	5-F	A6R15	7-H	A8R2	26-H
C35	9-D	Master Oscillator		A2C26	26-E	A2T4	25-F	A5L18	4-F	A6R16	9-H	A8R3	26-H
C36	10-D			A2C27	26-E			A5L19	4-F	A6R17	9-I	A8R4	Not Used
C37	9-E	A1C1	11-B	A2C28	28-F			A5L20	4-F	A6R18	9-H	A8R5	27-H
C38	9-E	A1C2	11-A	A2C29	27-E	I-F Mixers		A5L21	4-F	A6R19	Not Used	A8R6	27-H
C40	3-D	A1C3	12-B	A2C30	27-F			A5L22	3-F	A6R20	7-I	A8R7	26-I
CR1	5-B	A1C4	12-B	A2C31	26-F	A3C1	17-E	A5L23	3-F			A8V1	25-H
CR2	4-B	A1C5	13-B	A2C32	25-F	A3C2	Not Used	A5L24	3-F	Reference			
CR3	4-C	A1C6	10-B	A2C33	25-E	A3C3	17-F	A5L25	3-F	I-F Amplifier			
CR4	4-D	A1C7	14-B	A2C34	24-E	A3C4	Not Used	A5L26	2-F				
CR5	6-E	A1C8	15-B	A2C35		A3C5	Not Used	A5P1	13G	A7C1	15-H		
CR6	6-E	A1C9	15-B	A2C36		A3C6	19-E	A5R1	11-F	A7C2	16-H		
CR7	4-D	A1C10	16-B	A2C37	27-F	A3C7	19-E	A5R2	11-F	A7C3	16-H		
FL1	12D	A1C11	15-B	A2CR1	26-F	A3C8	19-C	A5R3	12-F	A7C4	Not Used		
J2	4D	A1CR1	15A	A2CR2	26-E	A3C9	Not Used	A5R4	12-F	A7C5	17-H		

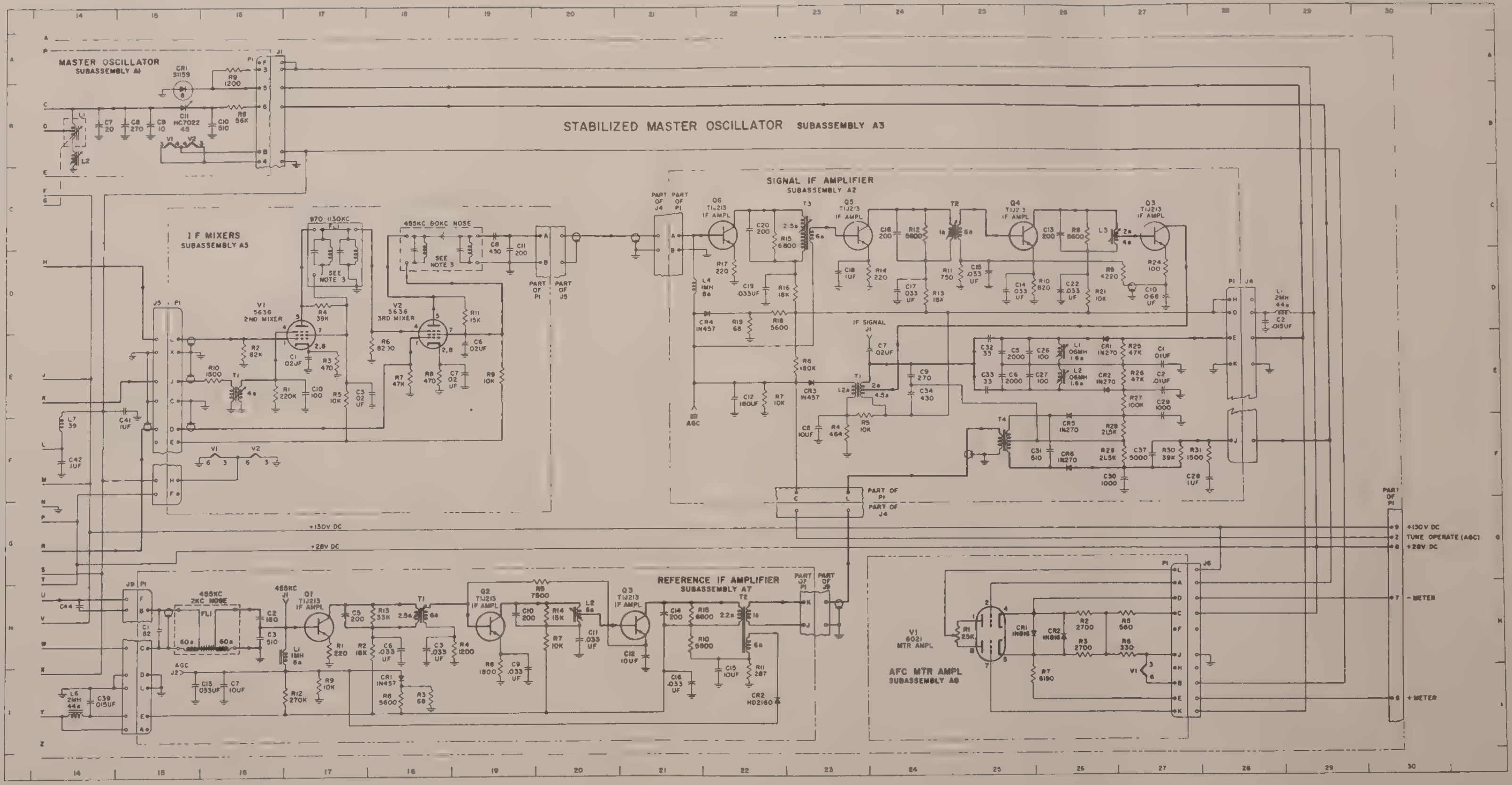
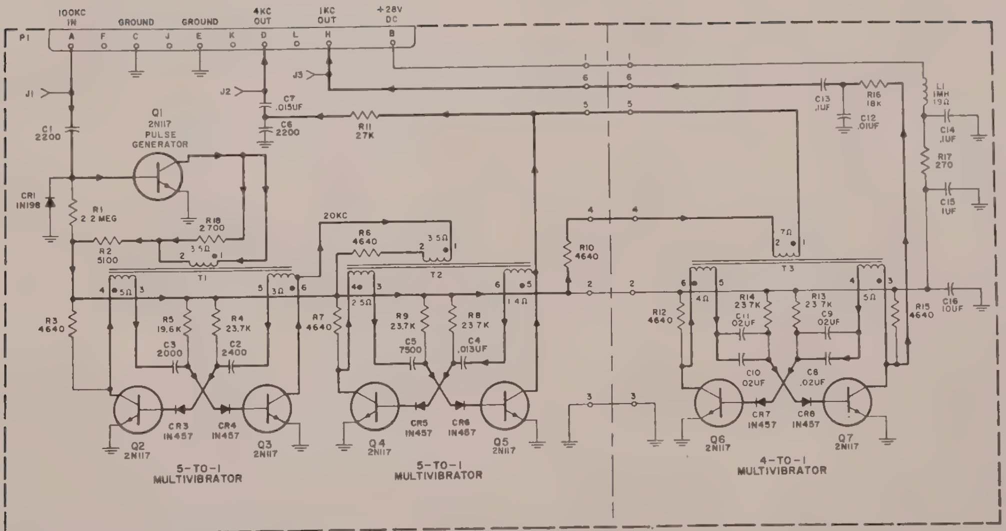

MASTER OSCILLATOR SUBASSEMBLY A1
STABILIZED MASTER OSCILLATOR SUBASSEMBLY A3
SIGNAL IF AMPLIFIER SUBASSEMBLY A2
I F MIXERS SUBASSEMBLY A3
V1 5636 2ND MIXER
V2 5636 3RD MIXER
970 1130KC
455KC 60KC NOSE
SEE NOTE 3
Q6 TIJ213 IF AMPL
Q5 TIJ213 IF AMPL
Q4 TIJ213 IF AMPL
Q3 TIJ213 IF AMPL
IF SIGNAL J1
AGC
PART OF P1
PART OF J4
+130V DC
+28V DC
REFERENCE IF AMPLIFIER SUBASSEMBLY A7
455KC 2KC NOSE
455KC J1
Q1 TIJ213 IF AMPL
Q2 TIJ213 IF AMPL
Q3 TIJ213 IF AMPL
AFC MTR AMPL SUBASSEMBLY A8
V1 6021 MTR AMPL
+130V DC
TUNE OPERATE (AGC)
+28V DC
- METER
+ METER

Figure 5-107. Converter-Oscillator CV-731/URC, Stabilized Master Oscillator (SMO), Model C, Schematic Diagram (Sheet 2 of 2)


100KC IN
GROUND
GROUND
4KC OUT
1KC OUT
+28V DC
P1
A
F
C
J
E
K
D
L
H
B
J1
J2
J3
C1 2200
C7 .015UF
C6 2200
R11 27K
Q1 2N117 PULSE GENERATOR
CR1 1N198
R1 2.2 MEG
R18 2700
R2 5100
3.5Ω
20KC
R6 4640
3.5Ω
T1
T2
T3
5Ω
3Ω
2.5Ω
1.4Ω
R3 4640
R5 19.6K
R4 23.7K
C3 2000
C2 2400
R7 4640
R9 23.7K
R8 23.7K
C5 7500
C4 .013UF
CR3 1N457
CR4 1N457
CR5 1N457
CR6 1N457
Q2 2N117
Q3 2N117
Q4 2N117
Q5 2N117
5-TO-1 MULTIVIBRATOR
5-TO-1 MULTIVIBRATOR
C13 .1UF
C12 .01UF
R16 18K
L1 1MH 19Ω
C14 .1UF
R17 270
C15 1UF
R10 4640
7Ω
R12 4640
4Ω
R14 23.7K
R13 23.7K
C11 .02UF
C9 .02UF
5Ω
R15 4640
C16 10UF
C10 .02UF
C8 .02UF
CR7 1N457
CR8 1N457
Q6 2N117
Q7 2N117
4-TO-1 MULTIVIBRATOR

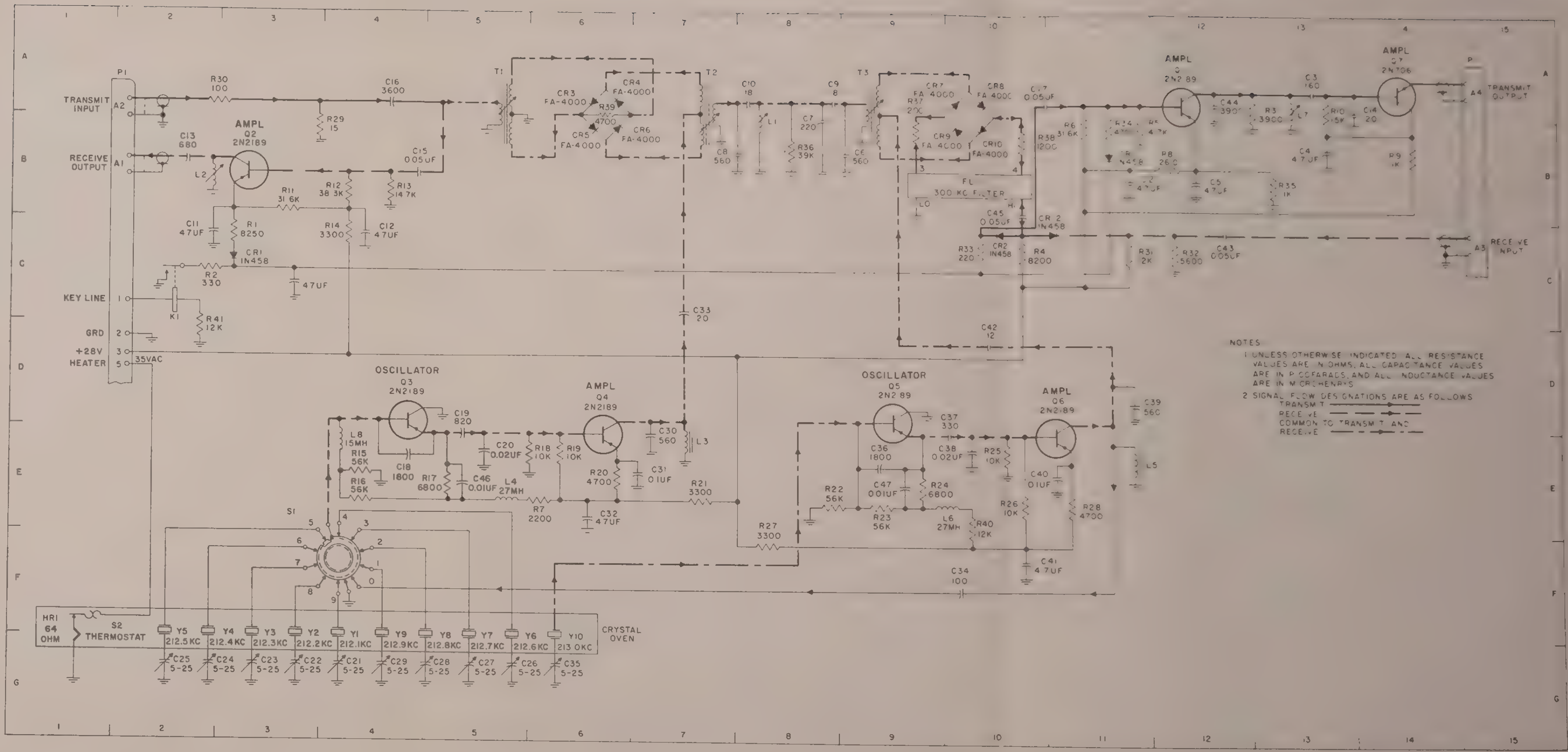
NOTES
1. UNLESS OTHERWISE INDICATED ALL RESISTANCE VALUES SHOWN IN OHMS, ALL CAPACITANCE VALUES IN UUF, AND ALL INDUCTANCE VALUES IN UH.
2. FOR DESTINATION OF INPUTS AND OUTPUTS OF P1, SEE CONVERTER-OSCILLATOR CV-731/URC CHASSIS SCHEMATIC DIAGRAM
3. REFERENCE DESIGNATIONS ARE ABBREVIATED, PREFIX DESIGNATIONS WITH UNIT NUMBER AND SUBASSEMBLY DESIGNATION.
4. ALL VOLTAGE AND RESISTANCE MEASUREMENTS TAKEN WITH VTVM TO GROUND. RESISTANCE MEASUREMENTS TAKEN WITH MODULE REMOVED FROM CHASSIS. ALL VOLTAGE MEASUREMENTS TAKEN WITH UNIT PLUGGED INTO CHASSIS OR CONNECTED WITH PENDANT CABLES, AND WITH A 100KC INPUT TO THE MODULE. BE CAREFUL IN MEASURING RESISTANCE AT TRANSISTOR TERMINALS TO OBSERVE PROPER POLARITY AND TO USE HIGHEST METER RANGE PRACTICABLE TO AVOID EXCESSIVE BASE CURRENT. BE SURE TO GROUND THE COMMON LEAD OF THE VTVM WHEN MAKING RESISTANCE MEASUREMENTS ON TRANSISTORS.

TRANSISTOR		PIN DESIGNATION		
		E	C	B
Q1	V	-	+10.5V 7.2 VAC	+0.28V 0.46 VAC
	R	0	4200	700
Q2	V	-	+8.9V 7.2 VAC	+0.58V 0.18 VAC
	R	0	18 to 20K	20 to 100K
Q3	V	-	-5.5V 6 VAC	-0.8V 6 VAC
	R	0	18 to 20K	20 to 100K
Q4	V	-	+9.6V 6.9 VAC	+0.52V 0.66 VAC
	R	0	18 to 20K	20 to 100K
Q5	V	-	-	-
	R	0	18 to 20K	20 to 100K
Q6	V	-	+7.2V 6.2 VAC	+0.44V 1.32 VAC
	R	0	18 to 20K	20 to 100K
Q7	V	-	+6.8V 5.8 VAC	+0.40V 1.2 VAC
	R	0	18 to 20K	20 to 100K

Figure 5-108. Converter-Oscillator CV-731/URC, Frequency Divider Module, Schematic Diagram

PART LOCATION INDEX

REF DESIG	LOC	REF DESIG	LOC	REF DESIG	LOC	REF DESIG	LOC
C1	2C	C34	9F	L6	9E	R23	9E
C2	11B	C35	6G	L7	13B	R24	9E
C3	13A	C36	9E	L8	4E	R25	10E
C4	13B	C37	9E	P1	2A/15A	R26	10E
C5	12B	C38	9E	Q1	12A	R27	8E
C6	8B	C39	11D	Q2	3B	R28	11E
C7	8B	C40	10E	Q3	4D	R29	4B
C8	8B	C41	10F	Q4	6D	R30	3A
C9	8B	C42	10D	Q5	9D	R31	11C
C10	8B	C43	12C	Q6	10D	R32	12C
C11	2C	C44	12A	Q7	14A	R33	10C
C12	4C	C45	10C	R1	3C	R34	11B
C13	2B	C46	5E	R2	2C	R35	13B
C14	14A	C47	9E	R3	13B	R36	8B
C15	4B	CR1	3C	R4	10C	R37	9A
C16	4A	CR2	10C	R5	11B	R38	10B
C17	10A	CR3	6B	R6	11B	R39	6A
C18	4E	CR4	6B	R7	6E	R40	10F
C19	5E	CR5	6B	R8	12B	S1	3E
C20	5E	CR6	6B	R9	14B	T1	5A
C21	4G	CR7	10B	R10	13A	T2	7A
C22	3G	CR8	10B	R11	3B	T3	9A
C23	3G	CR9	10B	R12	4B	Y1	4G
C24	3G	CR10	10B	R13	4B	Y2	3G
C25	2G	CR11	11B	R14	4C	Y3	3G
C26	5G	CR12	10C	R15	4E	Y4	3G
C27	5G	FL1	10B	R16	4E	Y5	2G
C28	5G	HR1	1F	R17	5E	Y6	6G
C29	4G	L1	8B	R18	6E	Y7	5G
C30	7E	L2	3B	R19	6E	Y8	5G
C31	7E	L3	7E	R20	6E	Y9	4G
C32	6E	L4	5E	R21	7E	Y10	6G
C33	7C	L5	11E	R22	8E		


TRANSMIT INPUT
RECEIVE OUTPUT
KEY LINE
GRD
+28V
HEATER
35VAC
P1
A2
A1
AMPL
Q2
2N2189
R30
100
C16
3600
R29
15
C13
680
L2
C15
0.05UF
R11
31.6K
R12
38.3K
R13
14.7K
C11
47UF
R1
8250
CR1
1N458
R14
3300
C12
47UF
R2
330
K1
R41
12K
47UF
T1
CR3
FA-4000
CR4
FA-4000
R39
4700
CR5
FA-4000
CR6
FA-4000
T2
C10
18
L1
C9
8
C7
220
C8
560
R36
39K
C6
560
T3
CR7
FA-4000
CR8
FA-4000
R37
27K
CR9
FA-4000
CR10
FA-4000
C17
0.05UF
R38
1200
FL
300 KC FILTER
LO
C45
0.05UF
CR12
1N458
R33
220
CR2
1N458
R4
8200
C33
20
C42
12
AMPL
Q1
2N2189
R6
316K
R24
4700
R5
4.7K
R8
26.1K
C44
390
R3
3900
L7
C3
160
R10
15K
C14
20
AMPL
Q7
2N706
C4
4.7UF
R9
1K
C2
4.7UF
C5
4.7UF
R35
1K
R31
2K
R32
5600
C43
0.05UF
TRANSMIT OUTPUT
A4
RECEIVE INPUT
A3
OSCILLATOR
Q3
2N2189
C19
820
L8
15MH
R15
56K
C18
1800
R16
56K
R17
6800
C20
0.02UF
C46
0.01UF
L4
27MH
R18
10K
R19
10K
AMPL
Q4
2N2189
R20
4700
C30
560
L3
C31
0.1UF
R21
3300
R7
2200
C32
47UF
S1
OSCILLATOR
Q5
2N2189
C37
330
C36
1800
C38
0.02UF
R25
10K
C47
0.01UF
R24
6800
R22
56K
R23
56K
L6
27MH
R40
12K
R27
3300
AMPL
Q6
2N2189
C40
0.1UF
R26
10K
R28
4700
C39
560
L5
C41
4.7UF
C34
100
HR1
64 OHM
S2
THERMOSTAT
Y5
212.5KC
Y4
212.4KC
Y3
212.3KC
Y2
212.2KC
Y1
212.1KC
Y9
212.9KC
Y8
212.8KC
Y7
212.7KC
Y6
212.6KC
Y10
213.0KC
CRYSTAL OVEN
C25
5-25
C24
5-25
C23
5-25
C22
5-25
C21
5-25
C29
5-25
C28
5-25
C27
5-25
C26
5-25
C35
5-25
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
A
B
C
D
E
F
G

NOTES:
1 UNLESS OTHERWISE INDICATED ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES ARE IN PICOFARADS AND ALL INDUCTANCE VALUES ARE IN MICROHENRYS.
2 SIGNAL FLOW DESIGNATIONS ARE AS FOLLOWS:
TRANSMIT
RECEIVE
COMMON TO TRANSMIT AND RECEIVE

Figure 5-111. Converter-Oscillator CV-731/URC, 0.1-Kc Tuning Module, Schematic Diagram

NOTES
1 UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES GIVEN IN OHMS
2 C1 THRU C35 ARE 1000UUF
3. FOR DESTINATION OF SIGNALS ON PLUGS J1 THRU J7, SEE MODULE SCHEMATIC DIAGRAMS INDICATED J14 NOT USED UNLESS AM MODULE IS INSTALLED ALL INPUT AND OUTPUT CONNECTIONS OF J11, J12, AND J13 ARE MADE THROUGH INTERCONNECTING BOX J-1007/U.
4. REFERENCE DESIGNATIONS ARE ABBREVIATED PREFIX DESIGNATIONS WITH UNIT NUMBER
5 ALL VOLTAGE AND RESISTANCE MEASUREMENTS TAKEN WITH VTVM TO GROUND RESISTANCE MEASUREMENTS TAKEN WITH CHASSIS DISCONNECTED VOLTAGE MEASUREMENTS TAKEN WITH POWER APPLIED, BUT WITH NO RF INPUT AND UNDER THE FOLLOWING CONDITIONS S4 IN SSB POSITION, S1 IN LOCAL POSITION, METER BALANCED, AND GAIN CONTROLS MAXIMUM COUNTERCLOCKWISE

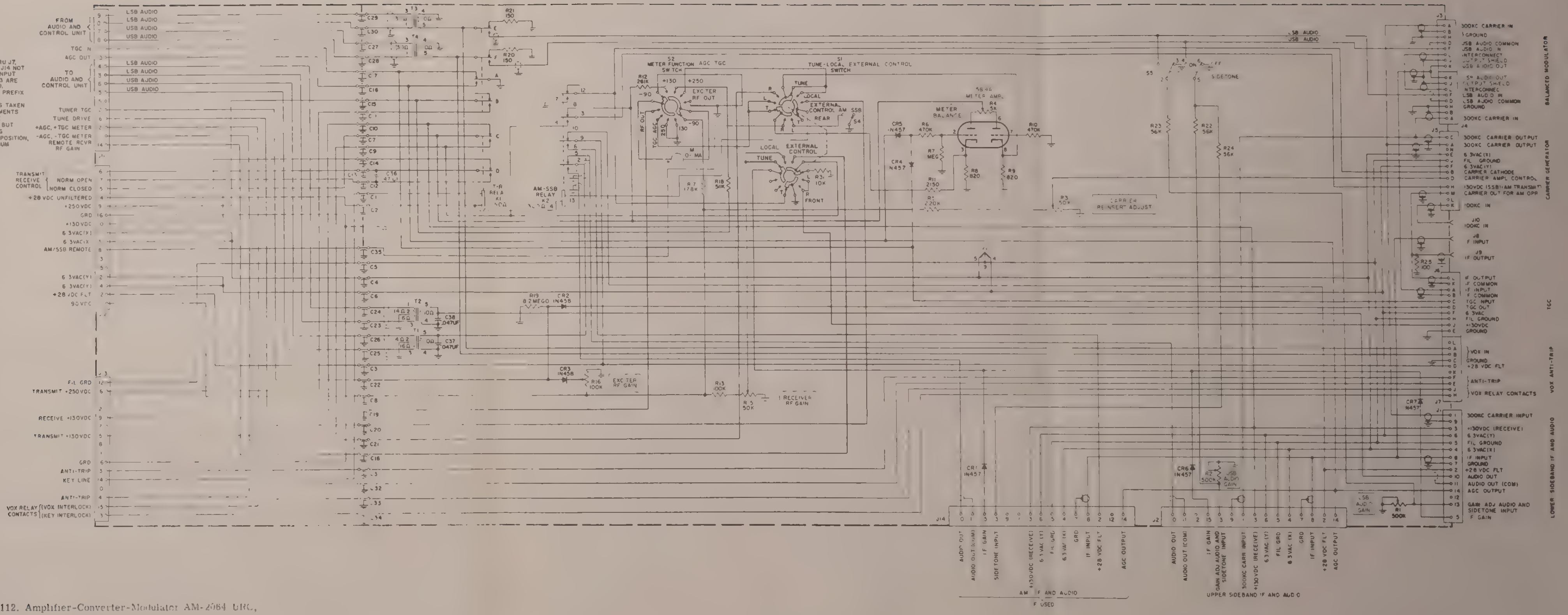
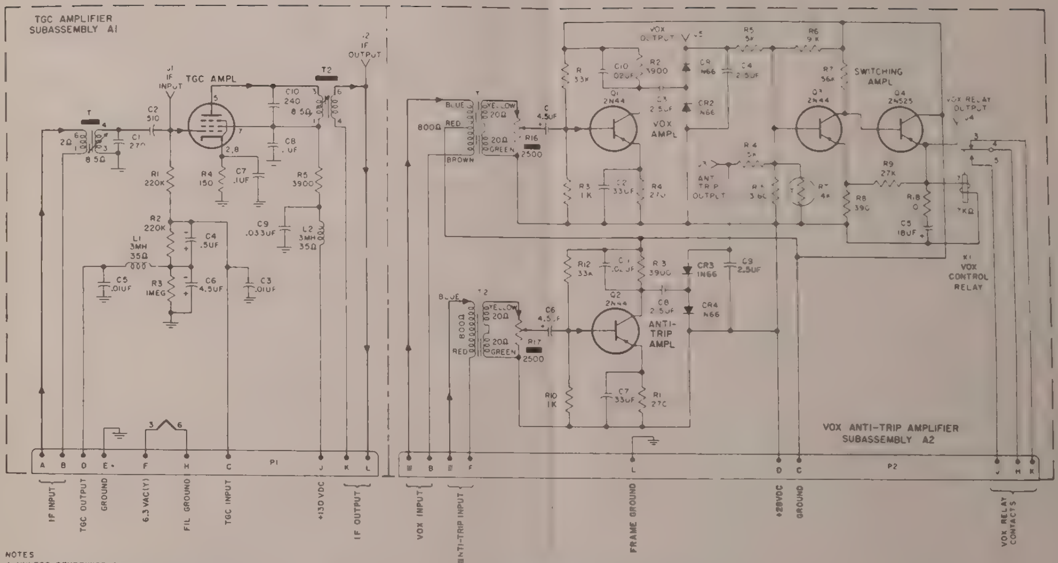

FROM AUDIO AND CONTROL UNIT
LSB AUDIO
USB AUDIO
TGC IN
AGC OUT
TO AUDIO AND CONTROL UNIT
TUNER TGC
TUNE DRIVE
+AGC, +TGC METER
-AGC, -TGC METER
REMOTE RCVR RF GAIN
TRANSMIT RECEIVE CONTROL
NORM OPEN
NORM CLOSED
+28 VDC UNFILTERED
+250VDC
GRD
+130VDC
6.3VAC(X)
6.3VAC(X)
AM/SSB REMOTE
6.3VAC(Y)
6.3VAC(Y)
+28 VDC FLT
90VDC
FIL GRD
TRANSMIT +250VDC
RECEIVE +130VDC
TRANSMIT +130VDC
GRD
ANTI-TRIP
KEY LINE
ANTI-TRIP
VOX RELAY CONTACTS
VOX INTERLOCK
KEY INTERLOCK
T-R RELAY
AM-SSB RELAY K2
S2 METER FUNCTION SWITCH
AGC TGC
EXCITER RF OUT
M 0-1 MA
S1 TUNE-LOCAL, EXTERNAL CONTROL SWITCH
TUNE
LOCAL
EXTERNAL CONTROL
AM SSB
S4
REAR
FRONT
5814 METER AMPL
METER BALANCE
CARRIER REINSERT ADJUST
SIDETONE
EXCITER RF GAIN
RECEIVER RF GAIN
300KC CARRIER IN
GROUND
USB AUDIO COMMON
USB AUDIO IN
INTERCONNECT
OUTPUT SHIELD
LSB AUDIO IN
LSB AUDIO COMMON
BALANCED MODULATOR
300KC CARRIER OUTPUT
6.3VAC(Y)
FIL GROUND
CARRIER CATHODE
CARRIER AMPL CONTROL
CARRIER OUT FOR AM OPR
CARRIER GENERATOR
100KC IN
IF INPUT
IF OUTPUT
IF COMMON
TGC INPUT
TGC OUT
6.3VAC
+130VDC
TGC
VOX IN
+28 VDC FLT
ANTI-TRIP
VOX RELAY CONTACTS
VOX ANTI-TRIP
300KC CARRIER INPUT
+130VDC (RECEIVE)
AUDIO OUT
AUDIO OUT (COM)
AGC OUTPUT
GAIN ADJ AUDIO AND SIDETONE INPUT
IF GAIN
LOWER SIDEBAND IF AND AUDIO
USB AUDIO GAIN
LSB AUDIO GAIN
J14
J2
SIDETONE INPUT
AM IF AND AUDIO
IF USED
UPPER SIDEBAND IF AND AUDIO

Figure 5-112. Amplifier-Converter-Modulator AM-2064 URC, Chassis Schematic Diagram

VACUUM TUBE VOLTAGE AND RESISTANCE CHART FOR AMPLIFIER-CONVERTER-MODULATOR AM-2064/URC, TGC-VOX ANTI-VOX MODULE

TUBE		PIN NUMBERS							
		1	2	3	4	5	6	7	8
A1V1	V	0	1.25V	6.3 VAC	NC	95V	0	0	NC
	R	1.44 MEG	150	INF	NC	INF	INF	INF	NC

TRANSISTOR		PIN DESIGNATION		
		e	c	b
Q1	V	24.2V	4V	24.2V
	R	2700	INF	4900
Q2	V	24.2V	4V	24.2V
	R	3K	1900	4600
Q3	V	24.2V	24.2V	24.2V
	R	4500	5100	3900
Q4	V	24.2V	0	24.2V
	R	520	0	5100


TGC AMPLIFIER SUBASSEMBLY A1
J1 IF INPUT
TGC AMPL
J2 IF OUTPUT
T
T2
2Ω
8.5Ω
C1 270
C2 510
C10 240
C8 .UF
R1 220K
R4 150
C7 .1UF
R5 3900
R2 220K
L1 3MH 35Ω
C4 .5UF
C9 .033UF
L2 3MH 35Ω
C5 .01UF
R3 1MEG
C6 4.5UF
C3 .01UF
P1
A B D E F H C J K L
IF INPUT
TGC OUTPUT
GROUND
6.3 VAC(Y)
FIL GROUND
TGC INPUT
+130 VDC
IF OUTPUT
VOX OUTPUT
R5 5K
R6 9K
R 33K
C10 .02UF
R2 3900
CR1 1N66
C4 2.5UF
R7 56K
SWITCHING AMPL
Q1 2N44
C3 2.5UF
CR2 1N66
VOX AMPL
Q3 2N44
Q4 2N525
VOX RELAY OUTPUT
BLUE
YELLOW 20Ω
800Ω
RED
20Ω GREEN
BROWN
C 4.5UF
R16 2500
R3 1K
C2 33UF
R4 270
ANTI TRIP OUTPUT
R9 27K
R8 390
C5 18UF
K1 VOX CONTROL RELAY
R12 33K
R13 3900
CR3 1N66
C9 2.5UF
Q2 2N44
C8 2.5UF
CR4 1N66
T2
C6 4.5UF
R17 2500
ANTI-TRIP AMPL
R10 1K
C7 33UF
R11 270
VOX ANTI-TRIP AMPLIFIER SUBASSEMBLY A2
P2
B F L D C J H K
VOX INPUT
ANTI-TRIP INPUT
FRAME GROUND
+28VDC
GROUND
VOX RELAY CONTACTS

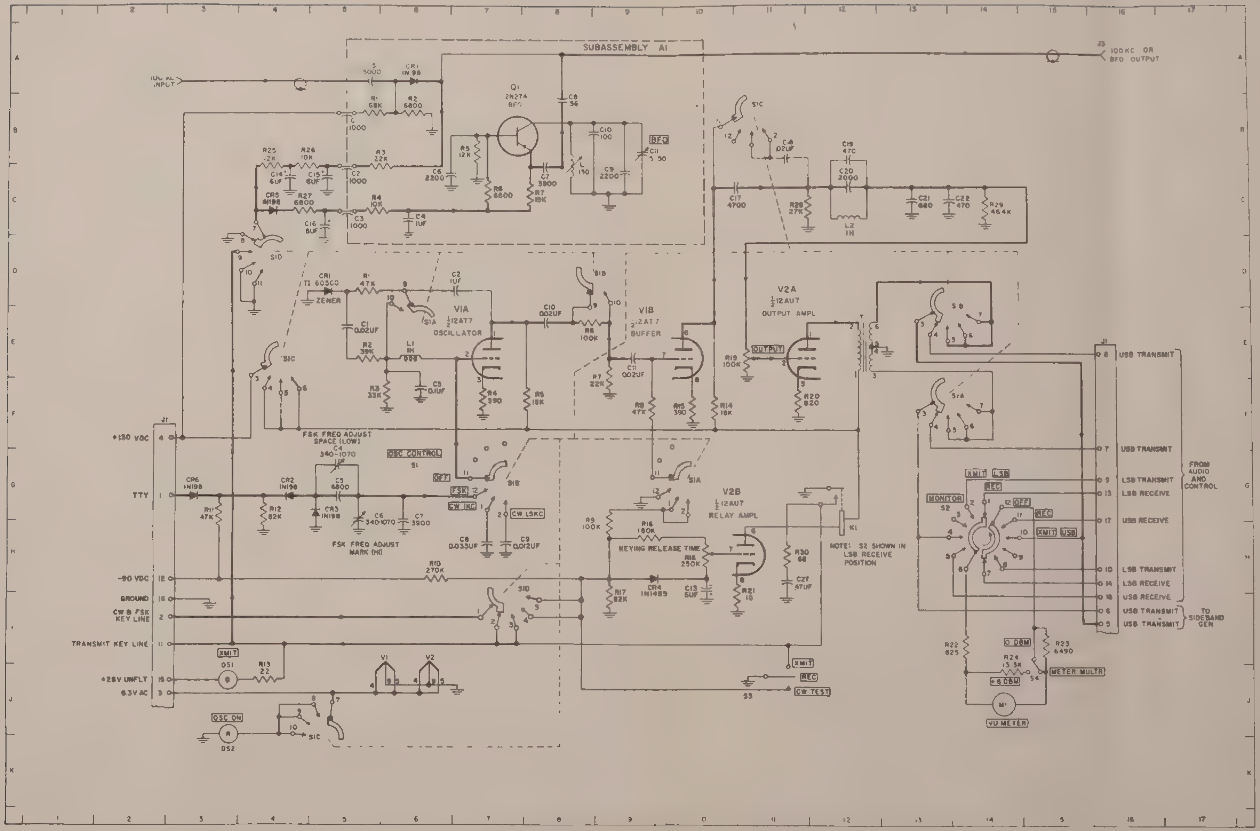
NOTES

1. UNLESS OTHERWISE SPECIFIED ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES ARE IN UUF AND ALL INDUCTANCE VALUES ARE IN UH.
2. REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX DESIGNATIONS WITH UNIT NUMBER AND SUBASSEMBLY DESIGNATION.
3. FOR DESIGNATION OF INPUTS AND OUTPUTS OF A1P1 AND P2, SEE SIDEBAND GENERATOR 786F-1 CHASSIS SCHEMATIC DIAGRAM.
4. ALL RESISTANCE AND VOLTAGE MEASUREMENTS TAKEN TO GROUND WITH VTVM. RESISTANCE MEASUREMENTS TAKEN WITH MODULE REMOVED FROM CHASSIS AND POSITIVE LEAD TO GROUND. VOLTAGE MEASUREMENTS TAKEN WITH UNIT IN CHASSIS, 30V DC APPLIED, NO SIGNAL INPUT AND WITH NEGATIVE LEAD TO GROUND. NC IN TABLE MEANS NOT CONNECTED. BE CAREFUL IN MEASURING RESISTANCE AT TRANSISTOR TERMINALS TO OBSERVE PROPER POLARITY AND TO USE THE HIGHEST METER RANGE PRACTICABLE TO AVOID EXCESSIVE BASE CURRENT IN THE TRANSISTOR.
5. DC RESISTANCE OF COILS LESS THAN ONE OHM HAVE BEEN OMMITTED.

REF DES		PIN NUMBERS							
			2	3	4	5	6	7	8
A1V1	V	0	1.25V	6.3V AC	NC	95V	0	0	NC
	R	44 MEG	150	INF	NC	INF	INF	INF	NC

REF DES		PIN DESIGNATION		
		e	c	b
Q1	V	24.2V	4V	24.2V
	R	2700	INF	4900
Q2	V	24.2V	4V	24.2V
	R	3K	1900	4600
Q3	V	24 2V	24 2V	24 2V
	R	4500	5100	3900
Q4	V	24 2V	0	24.2V
	R	520	0	5100

Figure 5-118. Amplifier-Converter-Modulator AM-2064/URC, TGC-VOX Anti-VOX Module, Schematic Diagram (For Information Only, Not Normally Supplied with AN/URC-32( ))

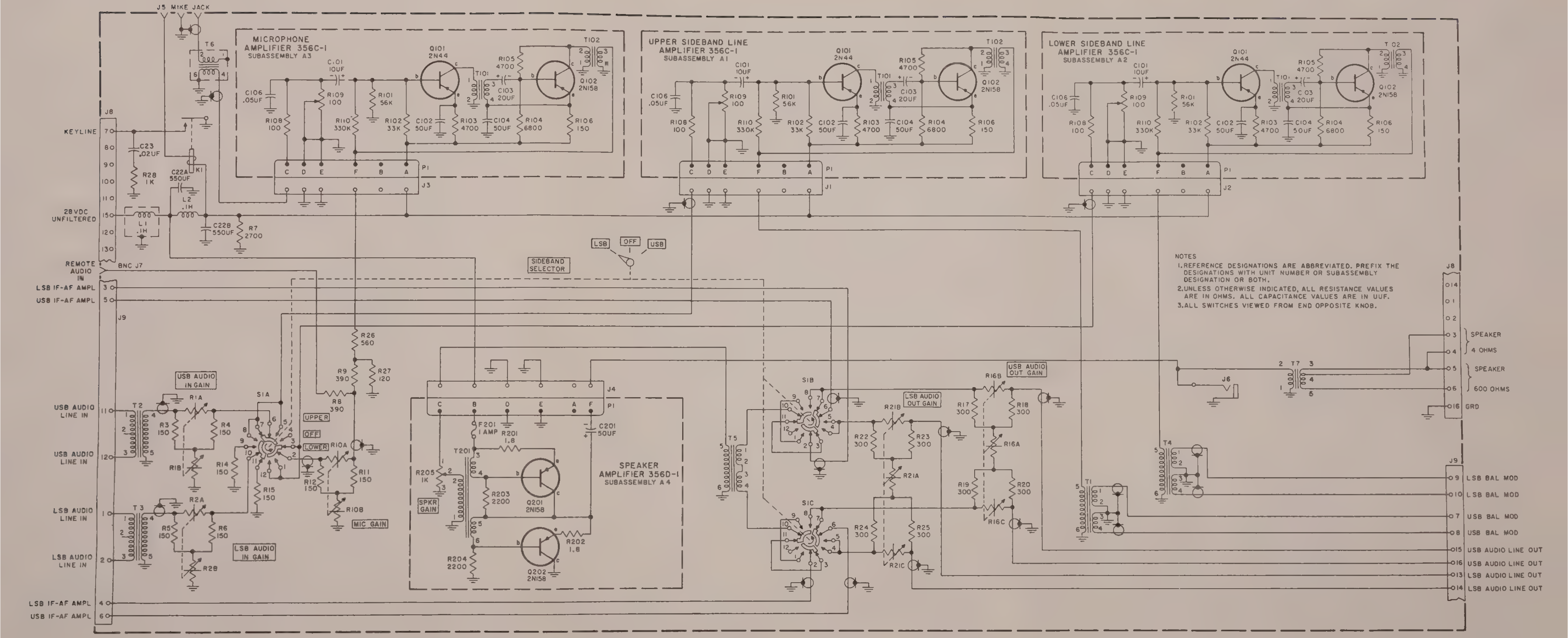

SUBASSEMBLY A1
100 KC INPUT
C5 5000
CR1 1N98
R1 68K
R2 6800
C1 1000
Q1 2N274 BFO
C8 56
C10 100
BFO
C11 5-50
L 150
C9 2200
C7 3900
C6 2200
R5 12K
R6 6800
R7 15K
R3 22K
R4 10K
C4 1UF
C2 1000
C3 1000
R25 12K
R26 10K
C14 6UF
C15 6UF
CR5 1N198
R27 6800
C16 6UF
S1D
S1C
J3 100KC OR BFO OUTPUT
C17 4700
C18 .02UF
C19 470
C20 2000
L2 1H
R28 27K
C21 680
C22 470
R29 46.4K
CR1 TI 605C0 ZENER
R1 47K
C2 1UF
C1 0.02UF
R2 39K
L1 1H
R3 33K
C3 0.1UF
V1A 1/2 12AT7 OSCILLATOR
S1A
R4 390
R5 18K
C10 .002UF
R6 100K
S1B
V1B 1/2 12AT7 BUFFER
C11 .002UF
R7 22K
R8 47K
R15 390
R14 18K
V2A 1/2 12AU7 OUTPUT AMPL
OUTPUT
R19 100K
R20 820
T1
S B
S1A
J1
+130 VDC
TTY
-90 VDC
GROUND
CW & FSK KEY LINE
TRANSMIT KEY LINE
+28V UNFLT
6.3V AC
CR6 1N198
R11 47K
R12 82K
CR2 1N196
CR3 1N198
FSK FREQ ADJUST SPACE (LOW)
C4 340-1070
C5 6800
C6 340-1070
C7 3900
FSK FREQ ADJUST MARK (HI)
OSC CONTROL
S1
OFF
FSK
CW 1KC
CW 1.5KC
C8 0.033UF
C9 0.012UF
R10 270K
XMIT
DS1
R13 22
V1
V2
OSC ON
DS2
R9 100K
R16 180K
KEYING RELEASE TIME
R18 250K
CR4 1N1489
C13 6UF
R17 82K
V2B 1/2 12AU7 RELAY AMPL
R21 18
R30 68
C27 .47UF
K1
XMIT
REC
CW TEST
S3
MONITOR
S2
XMIT
LSB
REC
OFF
REC
XMIT
USB
R22 825
R23 6490
O DBM
R24 13.3K
+8 DBM
S4
METER MULTR
M1
VU METER
USB TRANSMIT
USB TRANSMIT
LSB TRANSMIT
LSB RECEIVE
USB RECEIVE
LSB TRANSMIT
LSB RECEIVE
USB RECEIVE
FROM AUDIO AND CONTROL
USB TRANSMIT
USB TRANSMIT
TO SIDEBAND GEN

NOTE: S2 SHOWN IN LSB RECEIVE POSITION

Figure 5-119. Converter-Monitor CV-730/URC, Schematic Diagram

PART LOCATION INDEX

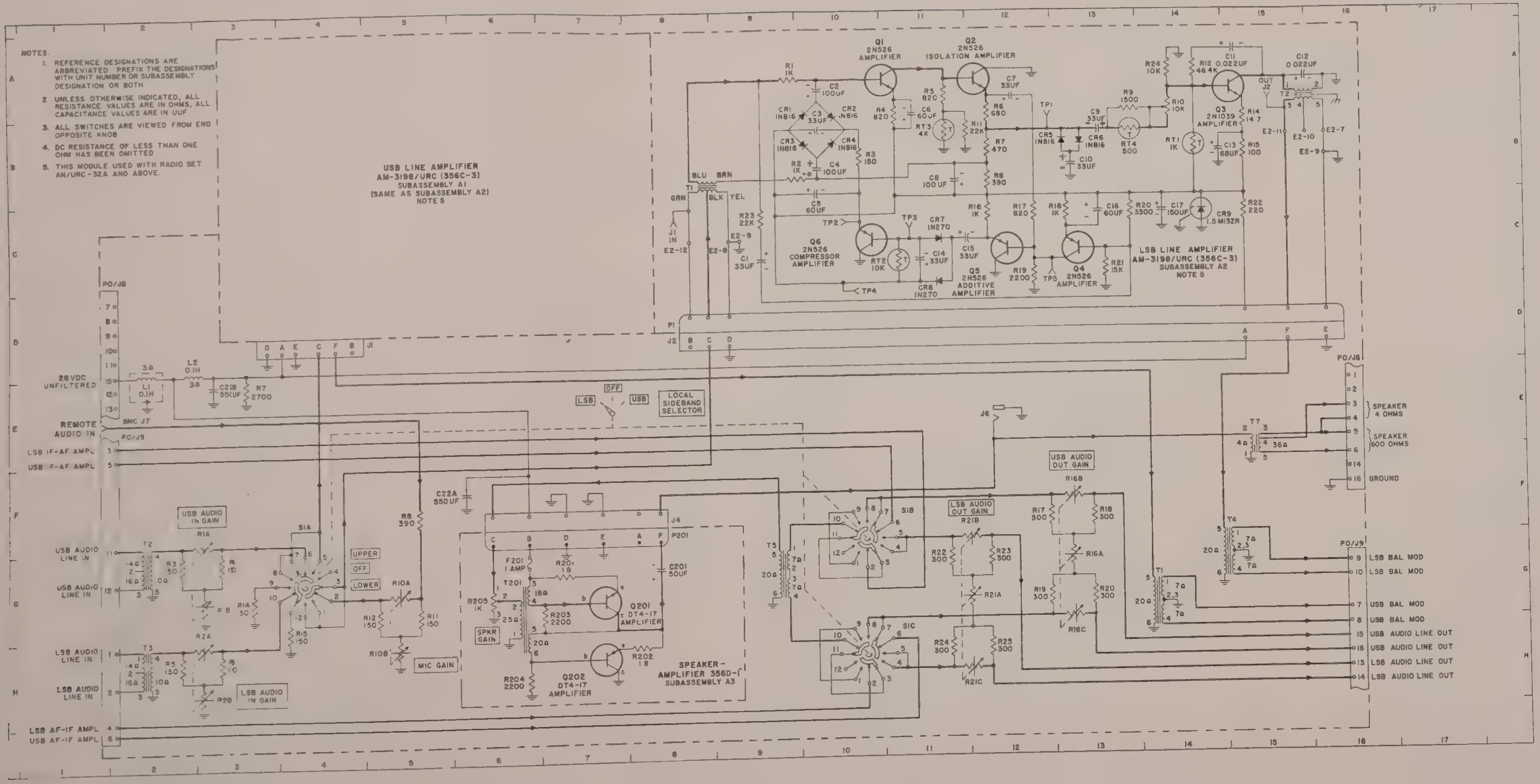
REF DESIG	LOC	REF DESIG	LOC
A1R1	5B	C10	8E
A1R2	6B	C11	9E
A1R3	5C	C12	
A1R4	5C	C13	10H
A1R5	7B	C14	4C
A1R6	7C	C15	5C
A1R7	8C	C16	5C
A1C1	5B	C17	10C
A1C2	5C	C18	11B
A1C3	5C	C19	12B
A1C4	6C	C20	12C
A1C5	5A	C21	13C
A1C6	6C	C22	13C
A1C7	8C	C27	11H
A1C8	8B	DS1	3J
A1C9	9C	DS2	3K
A1C10	8B	CR1	5D
A1C11	9B	CR2	4G
CR1	6A	CR3	5G
Q1	7B	CR4	9H
R1	5D	CR5	4C
R2	5E	CR6	3G
R3	6F	S1A	13F
R4	7F	S1A	6E
R5	8F	S1A	10G
R6	8E	S1B	7G
R7	9E	S1B	9D
R8	9F	S1C	4E
R9	9H	S1C	5J
R10	6H	S1C	11B
R11	3G	S1D	4D
R12	4G	S1D	7I
R13	4J	S1B	13D
R14	10F	S2	14H
R15	10F	S3	11J
R16	9H	S4	15J
R17	9I	L1	6E
R18	10H	L2	12C
R19	11E	V1	6J
R20	11F	V2	6J
R21	10I	V1A	7E
R22	14I	V1B	10E
R23	15I	V2A	11E
R24	15J	V2B	11H
R25	4C	K1	12H
R26	4C	M1	14J
R27	4C	T1	12E
R28	11C	J1	
R29	14C	J2	3A
R30	11H	J3	16A
C1	5E		
C2	7D		
C3	6F		
C4	5G		
C5	5G		
C6	5G		
C7	6G		
C8	7H		
C9	7H		


J5 MIKE JACK
T6
MICROPHONE
AMPLIFIER 356C-1
SUBASSEMBLY A3
C101
10UF
Q101
2N44
T102
R105
4700
T101
C103
20UF
Q102
2N158
C106
.05UF
R109
100
R101
56K
R108
100
R110
330K
R102
33K
C102
50UF
R103
4700
C104
50UF
R104
6800
R106
150
P1
J3
C D E F B A
UPPER SIDEBAND LINE
AMPLIFIER 356C-1
SUBASSEMBLY A1
J1
LOWER SIDEBAND LINE
AMPLIFIER 356C-1
SUBASSEMBLY A2
J2
J8
KEYLINE
C23
.02UF
R28
1K
C22A
550UF
K1
L2
.1H
28VDC
UNFILTERED
L1
.1H
C22B
550UF
R7
2700
REMOTE
AUDIO
IN
BNC J7
LSB IF-AF AMPL
USB IF-AF AMPL
J9
LSB
OFF
USB
SIDEBAND
SELECTOR
R26
560
R27
120
R9
390
R8
390
USB AUDIO
IN GAIN
USB AUDIO
LINE IN
T2
R1A
R3
150
R4
150
R1B
S1A
UPPER
OFF
LOWER
R10A
R11
150
R12
150
R10B
MIC GAIN
R14
150
R15
150
LSB AUDIO
LINE IN
T3
R2A
R5
150
R6
150
R2B
LSB AUDIO
IN GAIN
J4
P1
C B D E A F
F201
1 AMP
R201
1.8
C201
50UF
T201
R205
1K
SPKR
GAIN
R203
2200
Q201
2N158
SPEAKER
AMPLIFIER 356D-1
SUBASSEMBLY A4
R202
1.8
R204
2200
Q202
2N158
T5
S1B
S1C
USB AUDIO
OUT GAIN
LSB AUDIO
OUT GAIN
R16B
R17
300
R18
300
R21B
R22
300
R23
300
R16A
R21A
R19
300
R20
300
R16C
R24
300
R25
300
R21C
T1
T4
J6
T7
SPEAKER
4 OHMS
SPEAKER
600 OHMS
GRD
LSB BAL MOD
LSB BAL MOD
USB BAL MOD
USB BAL MOD
USB AUDIO LINE OUT
USB AUDIO LINE OUT
LSB AUDIO LINE OUT
LSB AUDIO LINE OUT

NOTES

1. REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATIONS WITH UNIT NUMBER OR SUBASSEMBLY DESIGNATION OR BOTH.
2. UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES ARE IN OHMS. ALL CAPACITANCE VALUES ARE IN UUF.
3. ALL SWITCHES VIEWED FROM END OPPOSITE KNOB.

Figure 5-120. Amplifier-Control AM-2062/URC, Schematic Diagram



NOTES.
1. REFERENCE DESIGNATIONS ARE ABBREVIATED PREFIX THE DESIGNATIONS WITH UNIT NUMBER OR SUBASSEMBLY DESIGNATION OR BOTH
2. UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES ARE IN UUF
3. ALL SWITCHES ARE VIEWED FROM END OPPOSITE KNOB
4. DC RESISTANCE OF LESS THAN ONE OHM HAS BEEN OMITTED
5. THIS MODULE USED WITH RADIO SET AN/URC-32A AND ABOVE.

USB LINE AMPLIFIER
AM-3198/URC (356C-3)
SUBASSEMBLY A1
(SAME AS SUBASSEMBLY A2)
NOTE 5
Q1 2N526 AMPLIFIER
Q2 2N526 ISOLATION AMPLIFIER
Q3 2N1039 AMPLIFIER
Q4 2N526 AMPLIFIER
Q5 2N526 ADDITIVE AMPLIFIER
Q6 2N526 COMPRESSOR AMPLIFIER
LSB LINE AMPLIFIER
AM-3198/URC (356C-3)
SUBASSEMBLY A2
NOTE 5
SPEAKER-AMPLIFIER 356D-1
SUBASSEMBLY A3
Q201 DT4-17 AMPLIFIER
Q202 DT4-17 AMPLIFIER
SPKR GAIN
MIC GAIN
USB AUDIO IN GAIN
LSB AUDIO IN GAIN
USB AUDIO OUT GAIN
LSB AUDIO OUT GAIN
LOCAL SIDEBAND SELECTOR
LSB
OFF
USB
UPPER
OFF
LOWER
28 VDC UNFILTERED
REMOTE AUDIO IN
LSB IF-AF AMPL
USB F-AF AMPL
USB AUDIO LINE IN
USB AUDIO LINE IN
LSB AUDIO LINE IN
LSB AUDIO LINE IN
LSB AF-IF AMPL
USB AF-IF AMPL
SPEAKER 4 OHMS
SPEAKER 600 OHMS
GROUND
LSB BAL MOD
LSB BAL MOD
USB BAL MOD
USB BAL MOD
USB AUDIO LINE OUT
USB AUDIO LINE OUT
LSB AUDIO LINE OUT
LSB AUDIO LINE OUT
S1A
S1B
S1C
T1
T2
T3
T4
T5
T7
J6
J4
P201
BNC J7
PO/J8
PO/J9
PO/J6
L1 0.1H
L2 0.1H
C22B 55UF
R7 2700
C22A 550UF
R8 390
F201 1 AMP
A
B
C
D
E
F
G
H
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17

Figure 5-121. Amplifier-Control AM-2062A/URC, Schematic Diagram

PART LOCATION INDEX

REF DESIG	LOC
SUBASSEMBLY A2	
A2C1	C9
A2C2	A10
A2C3	B10
A2C4	B10
A2C5	C10
A2C6	B11
A2C7	A12
A2C8	B11
A2C9	B13
A2C10	B13
A2C11	A15
A2C12	A15
A2C13	B14
A2C14	C11
A2C15	C12
A2C16	C13
A2C17	C14
A2R1	A9
A2R2	B9
A2R3	B10
A2R4	B11
A2R5	A11
A2R6	B12
A2R7	B12
A2R8	B12
A2R9	A13
A2R10	B14
A2R11	B12
A2R14	B15
A2R15	B15
A2R16	C12
A2R17	C12
A2R18	C13
A2R19	C12
A2R20	C13
A2R21	C13
A2R22	C15
A2R23	C9
A2R24	A14
A2RT1	B14
A2RT2	C11
A2RT3	B11
A2RT4	B13
A2Q1	A11
A2Q2	A12
A2Q3	A15
A2Q4	C13
A2Q5	C12
A2Q6	C10
A2TP1	B12
A2TP2	C10
A2TP3	C11
A2TP4	D10
A2TP5	C13
A2J1 (in)	C8
A2J2 (out)	A15
A2E2-7	B16
A2E2-8	C9
A2E2-9	C9
A2E2-10	B16
A2E2-11	B15
A2E2-12	C8
A2CR1	B10
A2CR2	B10
A2CR3	B10
A2CR4	B10
A2CR5	B13
A2CR6	B13
A2CR7	C11
A2CR8	D11
A2CR9	C14
A2T1	B8
A2T2	A15
SUBASSEMBLY A3	
A3C201	G8
A3R201	G7
A3R202	H8
A3R203	G7
A3R204	H6
A3R205	G6
A3T201	G6
A3F201	G6
A3Q201	G7
A3Q202	H7
CHASSIS COMPONENTS	
C22A	F6
C22B	E3
R1A	F3
R1B	G3
R2A	H3
R2B	H3
R3	G2
R4	G3
R5	H2
R6	H3
R7	E3
R8	F5
R9	
R10A	G5
R10B	H5
R11	G5
R12	G5
R13	
R14	G3
R15	G4
R16A	G13
R16B	F13
R16C	G13
R17	F12
R18	F13
R19	G12
R20	G13
R21A	G12
R21B	F12
R21C	H12
R22	G11
R23	G12
R24	H11
R25	H12
T1	G14
T2	G2
T3	H2
T4	G15
T5	G9
T7	E15
S1A	G4
S1B	F10
S1C	H10
L1	D2
L2	D2

ORIGINAL

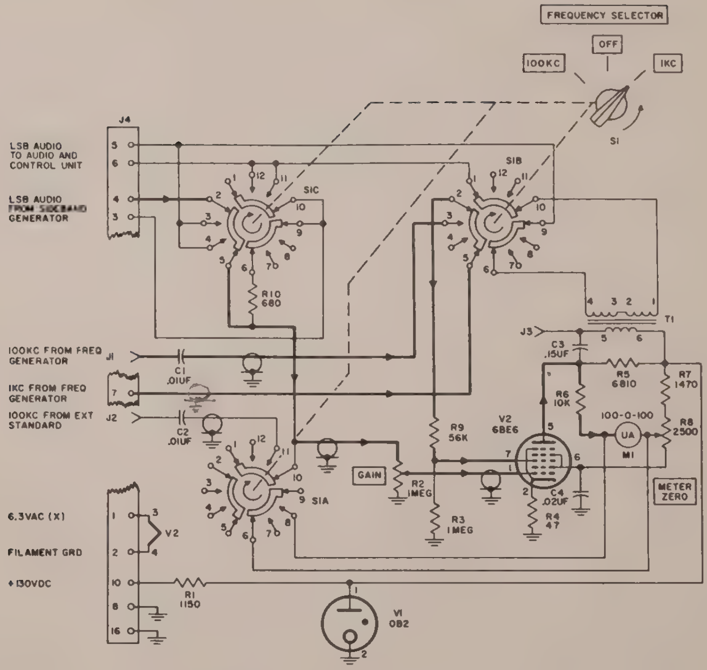
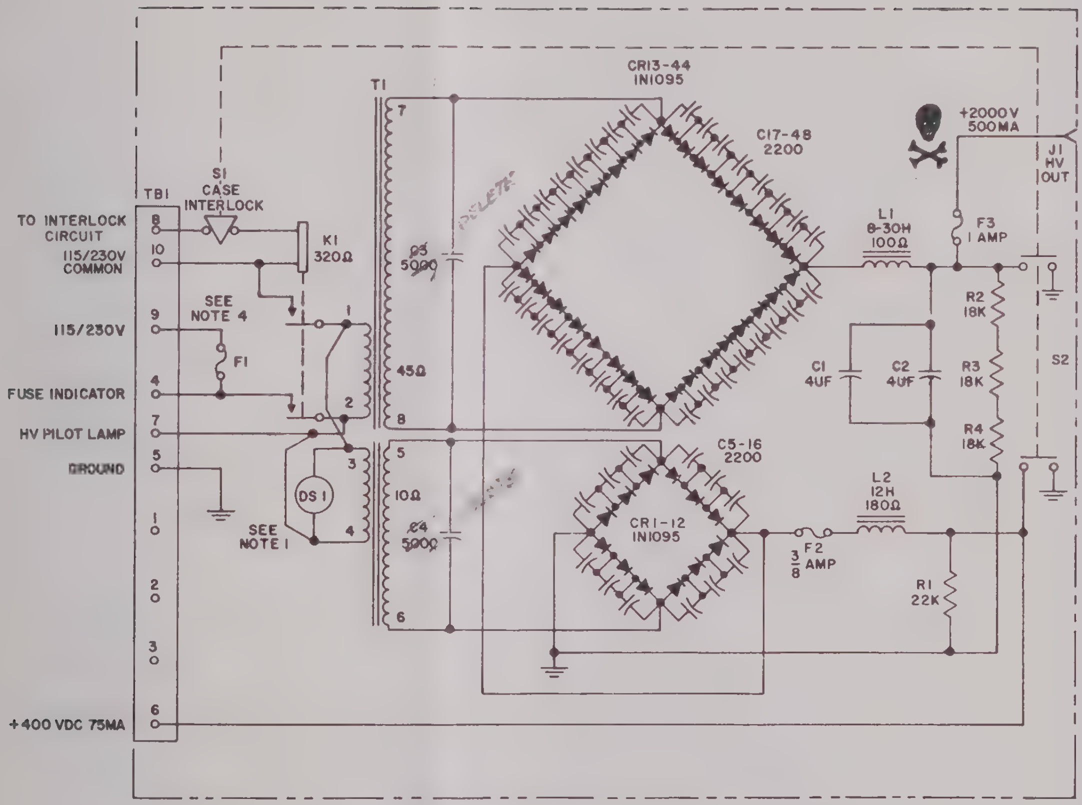

FREQUENCY SELECTOR
100KC
OFF
1KC
S1
J4
LSB AUDIO
TO AUDIO AND
CONTROL UNIT
LSB AUDIO
[redacted]
GENERATOR
S1C
S1B
R10
680
T1
J3
C3
.15UF
100KC FROM FREQ
GENERATOR
J1
C1
.01UF
1KC FROM FREQ
GENERATOR
100KC FROM EXT
STANDARD
J2
C2
.01UF
R5
6810
R6
10K
R7
1470
100-0-100
UA
M1
R8
2500
R9
56K
V2
6BE6
GAIN
R2
1MEG
S1A
C4
.02UF
R4
47
R3
1MEG
METER
ZERO
6.3VAC (X)
FILAMENT GRD
+130VDC
V2
R1
1150
V1
OB2

Figure 5-122. Signal Comparator CM-126/UR, Schematic Diagram


TB1
TO INTERLOCK CIRCUIT
115/230V COMMON
115/230V
FUSE INDICATOR
HV PILOT LAMP
GROUND
+400 VDC 75MA
8
10
9
4
7
5
1
2
3
6
S1 CASE INTERLOCK
K1 320Ω
SEE NOTE 4
F1
DS1
SEE NOTE 1
T1
1
2
3
4
7
45Ω
8
5
10Ω
6
~~C3~~ ~~5000~~
~~C4~~ ~~5000~~
DELETE
DELETE
CR13-44 1N1095
C17-48 2200
C5-16 2200
CR1-12 1N1095
+2000V 500MA
J1 HV OUT
F3 1 AMP
L1 8-30H 100Ω
R2 18K
R3 18K
R4 18K
S2
C1 4UF
C2 4UF
L2 12H 180Ω
F2 3/8 AMP
R1 22K

NOTES

1. JUMPERED FOR OPERATION WHEN USING 115 VAC AS PRIMARY INPUT. WHEN 230 VAC IS USED, REMOVE EXISTING JUMPERS, JUMPER PINS 2 AND 3, AND REMOVE INPUT LEAD AT PIN 2 AND CONNECT IT TO PIN 4.
2. ALL CAPACITANCE VALUES ARE IN PICOFARADS UNLESS OTHERWISE INDICATED.
3. ☠ SIGNIFIES DANGEROUSLY HIGH VOLTAGES EXIST. KEEP CLEAR! USE EXTREME CARE WHEN MEASURING.
4. FOR 115 VOLT OPERATION USE 15 AMP 250 VOLT FUSE, AND FOR 230 VOLT OPERATION USE 8 AMP 250 VOLT FUSE.

Figure 5-123. Power Supply PP-2153/U, Schematic Diagram

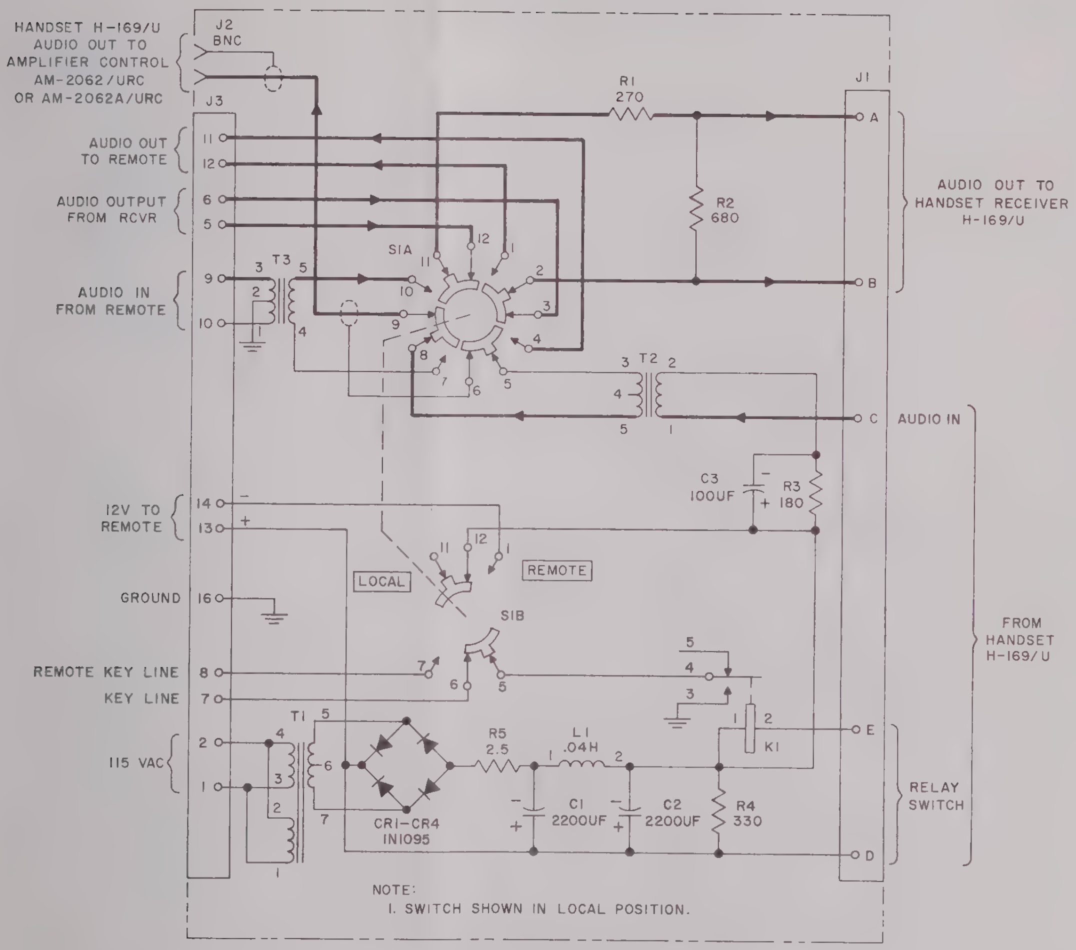
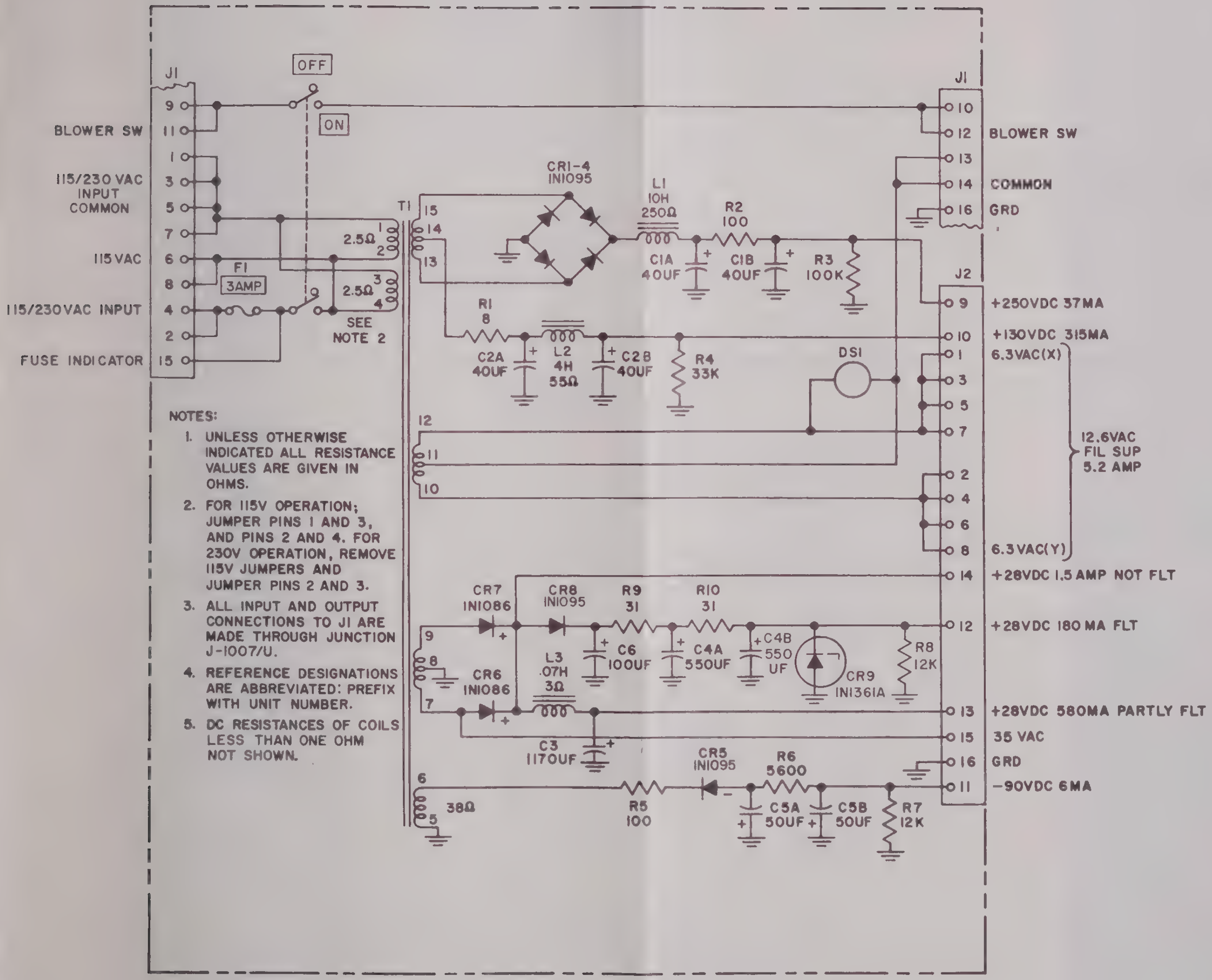

HANDSET H-169/U AUDIO OUT TO AMPLIFIER CONTROL AM-2062/URC OR AM-2062A/URC
J2 BNC
J3
AUDIO OUT TO REMOTE
AUDIO OUTPUT FROM RCVR
AUDIO IN FROM REMOTE
12V TO REMOTE
GROUND
REMOTE KEY LINE
KEY LINE
115 VAC
R1 270
R2 680
J1
AUDIO OUT TO HANDSET RECEIVER H-169/U
S1A
T3
T2
AUDIO IN
FROM HANDSET H-169/U
C3 100UF
R3 180
LOCAL
REMOTE
S1B
K1
T1
R5 2.5
L1 .04H
C1 2200UF
C2 2200UF
R4 330
CR1-CR4 IN1095
RELAY SWITCH
A
B
C
D
E
NOTE:
1. SWITCH SHOWN IN LOCAL POSITION.

Figure 5-124. Control-Power Supply C-2691/URC, Schematic Diagram


J1
OFF
ON
9
BLOWER SW 11
1
115/230 VAC INPUT COMMON
3
5
7
115VAC 6
8
F1 3AMP
115/230VAC INPUT 4
2
FUSE INDICATOR 15
T1
2.5Ω
1
2
2.5Ω
3
4
SEE NOTE 2
15
14
13
12
11
10
9
8
7
6
5
38Ω
CR1-4 IN1095
L1 10H 250Ω
R2 100
C1A 40UF
C1B 40UF
R3 100K
R1 8
C2A 40UF
L2 4H 55Ω
C2B 40UF
R4 33K
DS1
CR7 IN1086
CR8 IN1095
R9 31
R10 31
C6 100UF
C4A 550UF
C4B 550 UF
CR9 IN1361A
R8 12K
CR6 IN1086
L3 .07H 3Ω
C3 1170UF
CR5 IN1095
R6 5600
R5 100
C5A 50UF
C5B 50UF
R7 12K
J1
10
12 BLOWER SW
13
14 COMMON
16 GRD
J2
9 +250VDC 37MA
10 +130VDC 315MA
1 6.3VAC(X)
3
5
7
2
4
6
8 6.3VAC(Y)
12.6VAC FIL SUP 5.2 AMP
14 +28VDC 1.5 AMP NOT FLT
12 +28VDC 180 MA FLT
13 +28VDC 580MA PARTLY FLT
15 35 VAC
16 GRD
11 -90VDC 6MA

NOTES:

1. UNLESS OTHERWISE INDICATED ALL RESISTANCE VALUES ARE GIVEN IN OHMS.
2. FOR 115V OPERATION; JUMPER PINS 1 AND 3, AND PINS 2 AND 4. FOR 230V OPERATION, REMOVE 115V JUMPERS AND JUMPER PINS 2 AND 3.
3. ALL INPUT AND OUTPUT CONNECTIONS TO J1 ARE MADE THROUGH JUNCTION J-1007/U.
4. REFERENCE DESIGNATIONS ARE ABBREVIATED: PREFIX WITH UNIT NUMBER.
5. DC RESISTANCES OF COILS LESS THAN ONE OHM NOT SHOWN.

Figure 5-125. Power Supply PP-2154/U, Schematic Diagram

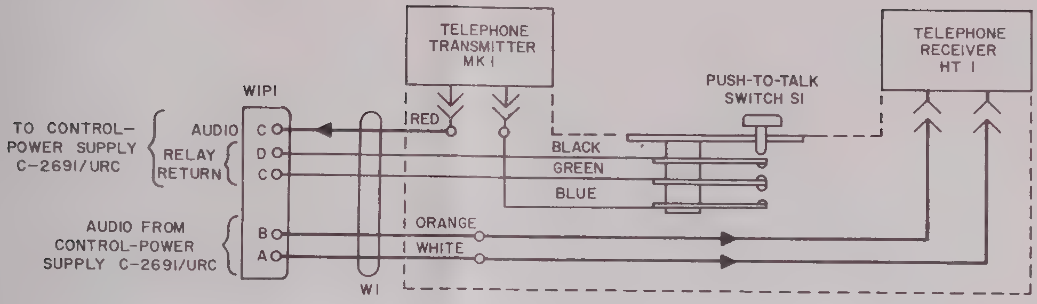

TELEPHONE TRANSMITTER MK I
TELEPHONE RECEIVER HT I
PUSH-TO-TALK SWITCH SI
WIPI
TO CONTROL-POWER SUPPLY C-2691/URC
AUDIO
RELAY RETURN
C
D
C
AUDIO FROM CONTROL-POWER SUPPLY C-2691/URC
B
A
RED
BLACK
GREEN
BLUE
ORANGE
WHITE
WI

Figure 5-126. Dynamic Handset H-169/U, Schematic Diagram

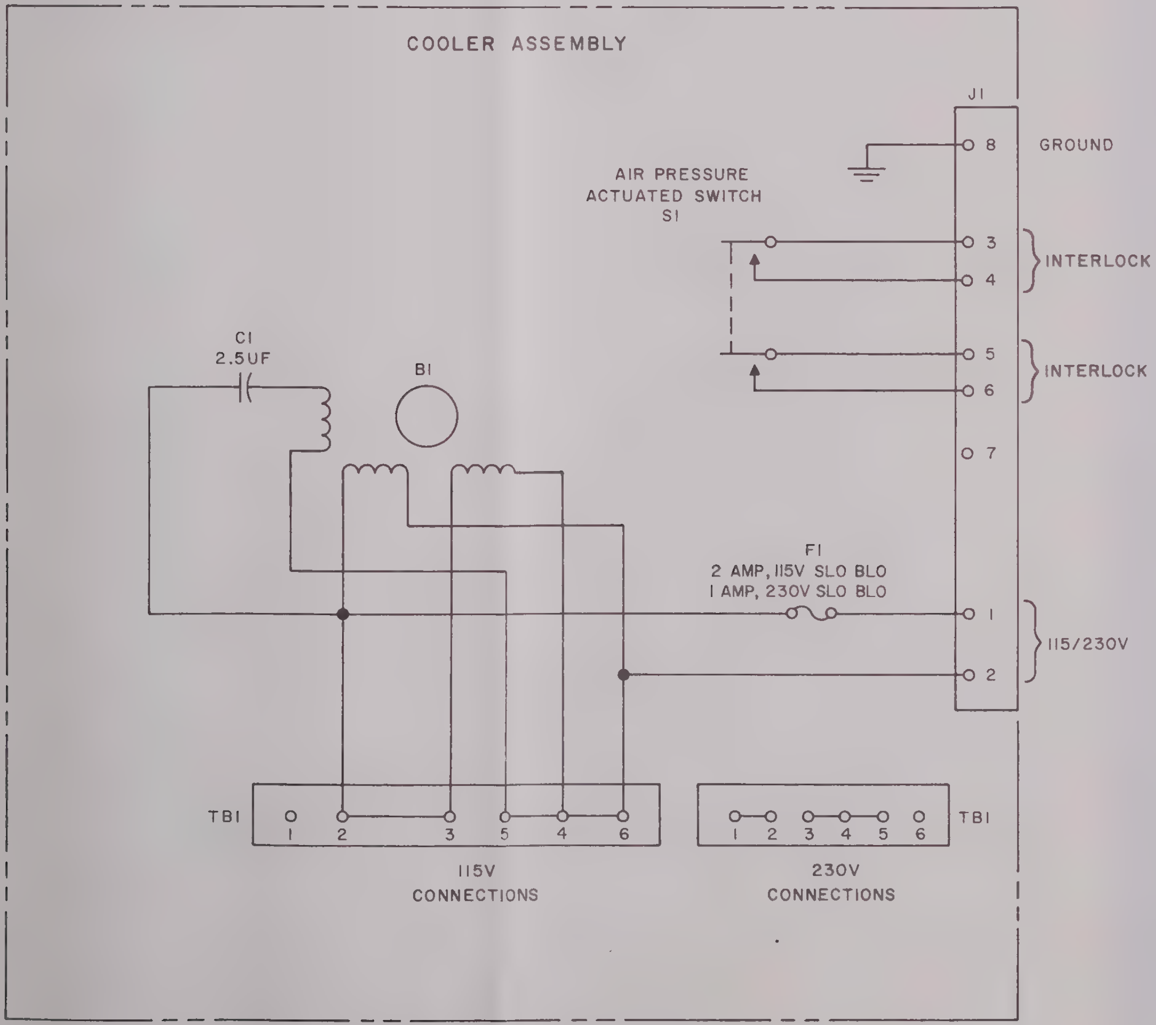
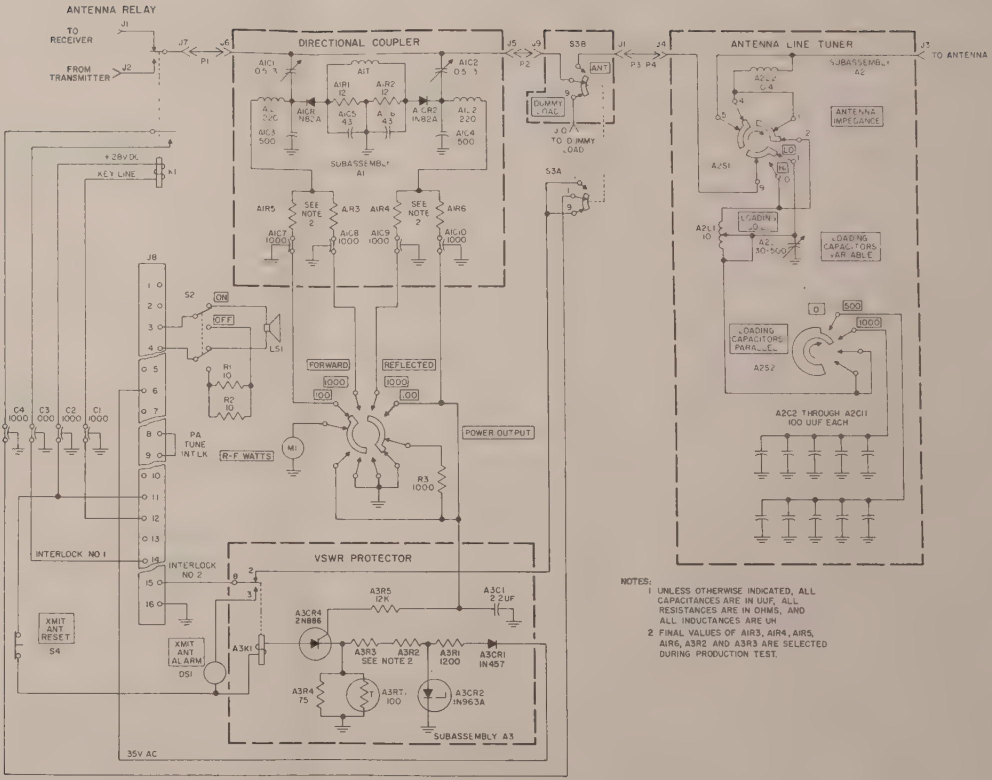

COOLER ASSEMBLY
JI
8
GROUND
AIR PRESSURE ACTUATED SWITCH SI
3
4
INTERLOCK
5
6
INTERLOCK
7
CI 2.5UF
BI
FI
2 AMP, II5V SLO BLO
I AMP, 230V SLO BLO
I
2
115/230V
TBI
I
2
3
5
4
6
115V CONNECTIONS
TBI
1
2
3
4
5
6
230V CONNECTIONS

Figure 5-127. Electronic Equipment Air Cooler HD-347/U, Schematic Diagram


ANTENNA RELAY
TO RECEIVER
J1
FROM TRANSMITTER
J2
J7
P1
J6
DIRECTIONAL COUPLER
A1C1 0.5-3
A1T
A1C2 0.5-3
A1R1 12
A1R2 12
A1L1 220
A1CR1 1N82A
A1C5 43
A1C6 43
A1CR2 1N82A
A1L2 220
A1C3 500
A1C4 500
SUBASSEMBLY A1
A1R5
SEE NOTE 2
A1R3
A1R4
SEE NOTE 2
A1R6
A1C7 1000
A1C8 1000
A1C9 1000
A1C10 1000
J5
J9
P2
S3B
ANT
DUMMY LOAD
J10
TO DUMMY LOAD
J1
J4
P3 P4
S3A
ANTENNA LINE TUNER
J3
TO ANTENNA
SUBASSEMBLY A2
A2L2 0.4
ANTENNA IMPEDANCE
LO
HI
A2S1
A2L1 10
LOADING COIL
A2C1 30-500
LOADING CAPACITORS VARIABLE
0
500
1000
LOADING CAPACITORS PARALLEL
A2S2
A2C2 THROUGH A2C11 100 UUF EACH
+28V DC
KEY LINE
K1
J8
S2
ON
OFF
LS1
R1 10
R2 10
PA TUNE INTLK
FORWARD
REFLECTED
1000
100
R-F WATTS
M1
POWER OUTPUT
R3 1000
C4 1000
C3 1000
C2 1000
C1 1000
INTERLOCK NO 1
INTERLOCK NO 2
VSWR PROTECTOR
A3R5 12K
A3C1 2.2UF
A3CR4 2N886
A3K1
A3R3
A3R2
SEE NOTE 2
A3R1 1200
A3CR1 1N457
A3R4 75
A3RT1 100
A3CR2 1N963A
SUBASSEMBLY A3
XMIT ANT RESET
S4
XMIT ANT ALARM
DS1
35V AC

NOTES:
1 UNLESS OTHERWISE INDICATED, ALL CAPACITANCES ARE IN UUF, ALL RESISTANCES ARE IN OHMS, AND ALL INDUCTANCES ARE UH
2 FINAL VALUES OF A1R3, A1R4, A1R5, A1R6, A3R2 AND A3R3 ARE SELECTED DURING PRODUCTION TEST.

Figure 5-128. Coupler Monitor CU-737/URC, Schematic Diagram

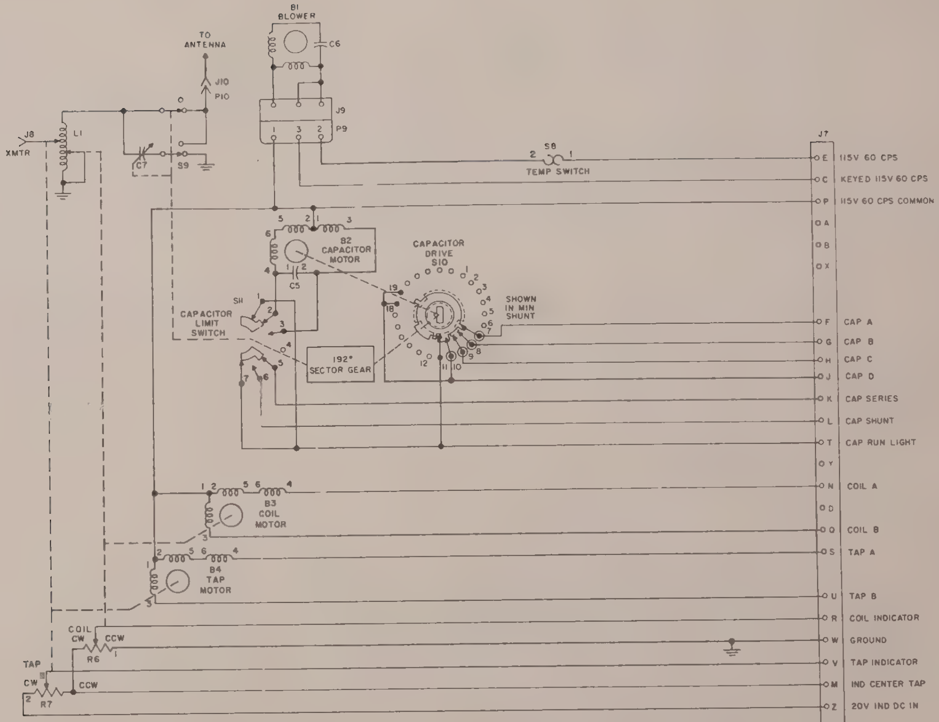
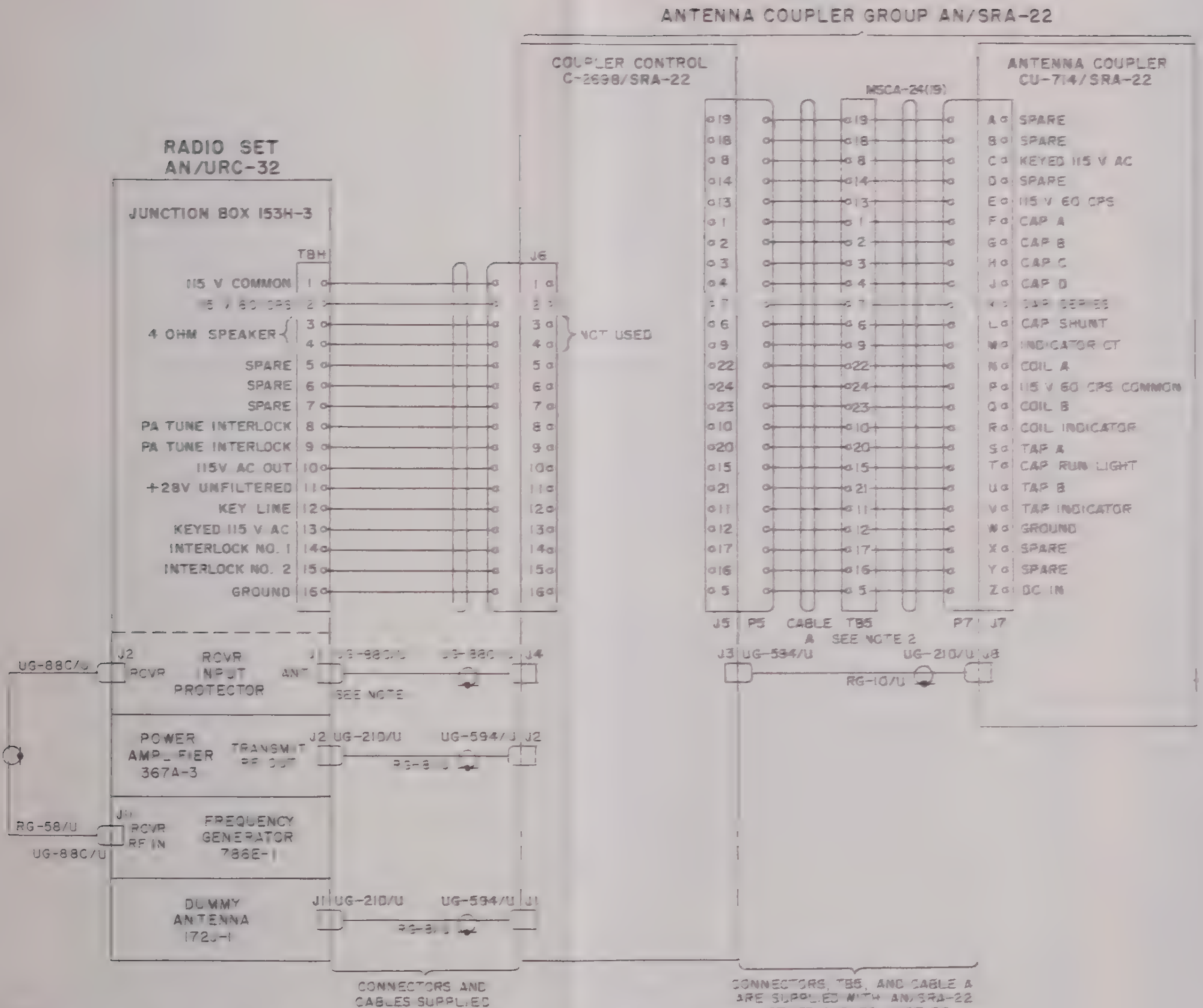

B1
BLOWER
C6
TO
ANTENNA
J10
P10
J9
P9
J8
XMTR
L1
C7
S9
S8
TEMP SWITCH
J7
E 115V 60 CPS
C KEYED 115V 60 CPS
P 115V 60 CPS COMMON
A
B
X
B2
CAPACITOR
MOTOR
C5
CAPACITOR
DRIVE
S10
SHOWN
IN MIN
SHUNT
S11
CAPACITOR
LIMIT
SWITCH
192°
SECTOR GEAR
F CAP A
G CAP B
H CAP C
J CAP D
K CAP SERIES
L CAP SHUNT
T CAP RUN LIGHT
Y
N COIL A
D
O COIL B
S TAP A
U TAP B
R COIL INDICATOR
W GROUND
V TAP INDICATOR
M IND CENTER TAP
Z 20V IND DC IN
B3
COIL
MOTOR
B4
TAP
MOTOR
COIL
CW
CCW
R6
TAP
CW
CCW
R7

Figure 5-129. Antenna Coupler Group AN/SRA-22,
Schematic Diagram


ANTENNA COUPLER GROUP AN/SRA-22
COUPLER CONTROL
C-2698/SRA-22
ANTENNA COUPLER
CU-714/SRA-22
MSCA-24(19)
RADIO SET
AN/URC-32
JUNCTION BOX 153H-3
TBH
J6
115 V COMMON
115 V 60 CPS
4 OHM SPEAKER
SPARE
SPARE
SPARE
PA TUNE INTERLOCK
PA TUNE INTERLOCK
115V AC OUT
+28V UNFILTERED
KEY LINE
KEYED 115 V AC
INTERLOCK NO. 1
INTERLOCK NO. 2
GROUND
NOT USED
A SPARE
B SPARE
C KEYED 115 V AC
D SPARE
E 115 V 60 CPS
F CAP A
G CAP B
H CAP C
J CAP D
K CAP SERIES
L CAP SHUNT
M INDICATOR CT
N COIL A
P 115 V 60 CPS COMMON
Q COIL B
R COIL INDICATOR
S TAP A
T CAP RUN LIGHT
U TAP B
V TAP INDICATOR
W GROUND
X SPARE
Y SPARE
Z DC IN
J5
P5
CABLE A
TB5
SEE NOTE 2
P7
J7
J3
UG-594/U
UG-210/U
J8
RG-10/U
J2
RCVR
RCVR INPUT PROTECTOR
ANT
J1
UG-88C/U
J4
SEE NOTE
UG-88C/U
POWER AMPLIFIER 367A-3
TRANSMIT RF OUT
J2
UG-210/U
UG-594/U
J2
RG-8/U
RG-58/U
J1
RCVR RF IN
FREQUENCY GENERATOR 786E-1
UG-88C/U
DUMMY ANTENNA 172J-1
J1
UG-210/U
UG-594/U
J1
RG-8/U
CONNECTORS AND CABLES SUPPLIED WITH AN/URC-32
CONNECTORS, TB5, AND CABLE A ARE SUPPLIED WITH AN/SRA-22 OTHER CABLES MUST BE FURNISHED BY INSTALLING ACTIVITY TO SUIT INSTALLATION

NOTES:

1. J4 ON C-2698/SRA-22 MAY BE CABLED (OR ROUTED THRU A PATCH PANEL) TO J1 ON RCVR INPUT PROTECTOR FOR RECEIVING ON SAME ANTENNA AS TRANSMITTING. ALTERNATELY, J1 MAY BE CONNECTED TO ANY OTHER RECEIVING ANTENNA.
2. BEGINNING WITH RADIO SET AN/URC-32 SERIAL NUMBER 360 THE ANTENNA COUPLER GROUP AN/SRA-22 IS SUPPLIED WITH CONNECTORS TB5 AND CABLE A.

Figure 5-130. Antenna Coupler Group AN/SRA-22, Remote Control, Schematic Diagram

INDEX

Paragraph (Figure) *Table

A

- Accessory Equipment *1-4, 1-6
- Adjustment and Alignments:
  - Amplifier-Control AM-2062( )/URC 5-2b(5)
  - Amplifier-Converter-Modulator AM-2064/URC 5-2b(3)
  - Converter-Monitor CV-730/URC 5-2b(4)
  - Converter-Oscillator CV-731/URC 5-2b(2)
  - Radio Frequency Amplifier AM-2061/URT 5-2b(1)
- AFC Meter Amplifier Subassembly Meter Balance Adjustment 5-2b(2)(e)9
- ALC Adjustment 5-2b(1)(d)
- Alignment and Adjustment 5-2b
- Amplifier-Control AM-2062( )/URC:
  - AM-2062/URC, Schematic Diagram (5-120)
  - AM-2062A/URC, Schematic Diagram (5-121)
  - Detailed Circuit Description 4-3f(2)
  - Determining Over-all Performance 4-3f(1)(a)
  - Equipment and Tools Required for Functional Testing 4-3f(1)(b)
  - Functional test data 4-3f(1)
  - Line Amplifier AM-3198/URC trouble shooting chart *4-9
  - Module Removal 5-3a(6)(b)
  - Removal 5-3a(6)(a)
  - Replacement 5-3a(6)(c)
- Amplifier-Converter-Modulator:
  - Chassis Schematic Diagram (5-112)
  - Detailed circuit description 4-3d(2)
  - Determining overhaul performance 4-3d(1)(a)
  - Equipment and tools required for functional testing 4-3d(1)(b)
  - Functional test data 4-3d(1)
  - Removal 5-3a(4)(a)
  - Removing modules from Amplifier-Converter-Modulator AM-2064/URC 5-3a(4)(b)
  - Replacement 5-3a(4)(c)
  - Sideband generator modules trouble isolation test-point voltages *4-6
  - Test equipment required for functional testing of AM-2064/URC *4-7
  - Test point location (5-9)
- Antenna Coupler Group AN/SRA-22 check 4-41

B

- Base Shockmount installation (2-2)
- BFO Frequency Adjustment 5-2b(4)(c)
- Bias Voltage Adjustment 5-2b(1)(a)
- Block diagrams:
  - functional:
    - Amplifier-Control AM-2062( )/URC (4-23)
    - Converter-Oscillator CV-731/URC (4-10)

Paragraph (Figure) *Table

B (Cont)

- Block diagrams:
  - functional: (Cont)
    - Radio Set AN/URC-32( ):
      - Control circuits (4-4)
      - Over-all (4-1)
      - Receive circuits (4-3)
      - Transmit circuits (4-2)
  - servicing:
    - Amplifier-Control AM-2062( )/URC (4-24)
    - Amplifier-Converter-Modulator AM-2064/URC (4-21)
    - Control-Power Supply C-2691/URC (4-26)
    - Converter Monitor CV-730/URC (4-22)
    - Converter Oscillator CV-731/URC (4-11)
    - Power Supply PP-2153/U (4-28)
    - Power Supply PP-2154/U (4-27)
    - Radio Frequency Amplifier AM-2061/URT (4-6)
    - Signal Comparator (4-25)
- Bulkhead Mounting Cable Diagram (5-91)
- Bureau of Ships installation 2-4a

C

- Cable assemblies 2-5
- Carrier reinsert adjustment 2-6b(2)
- Check-out procedures for Radio Set AN/URC-32( ) and Antenna Coupler Group AN/SRA-22 4-4
- Coaxial interunit connection diagram (5-88)
- Coaxial cable and connector fabrication (2-8)
- Connections to Antenna Network CU-737/URC 2-4g
- Connections to coupler control 2-4f
- Connections to external 100-kc frequency standard 2-4h
- Connections to the remote control position 2-4e
- Control circuits 4-2c
- Control-Power Supply C-2691/URC (1-8)
  - Detailed circuit description 4-3h(2)
  - Determining over-all performance 4-3h(1)(a)
  - Equipment required for functional testing 4-3h(1)(b)
  - Functional Test Data 4-3h(1)
  - Removal 5-3a(9)(a)
  - Replacement 5-3a(9)(h)
  - Schematic Diagram (5-124)
- Control settings for voice operation *3-2
- Converter-Monitor CV-730/URC (1-5)
  - Detailed circuit description 4-3e(2)
  - Determining over-all performance 4-3e(1)(a)
  - Equipment and tools required for functional testing 4-3e(1)(b)

INDEX (Cont)

Paragraph (Figure) *Table

C (Cont)

- Converter-Monitor CV-730/URC (Cont)
  - Functional test data . . . . 4-3e(1)
  - Removal . . . . 5-3a(5)(a)
  - Replacement . . . . 5-3a(5)(b)
  - Schematic Diagram . . . . (5-119)
  - Test equipment required for functional testing *4-8
  - Unit check 4-4f
- Converter-Oscillator CV-731/URC:
  - Calibration checks . . . . 4-3c(1)(a)4
  - Chassis circuits . . . . 4-3c(2)
  - Detailed circuit description . . . . . 4-3c(2)
  - Determining overall performance . . 4-3c(1)(a)
  - Equipment and tools required for functional testing . . . . 4-3c(1)(b)
  - Frequency change drive adjustments . (5-16)
  - Functional test data . . . . 4-3c(1)
  - Module location . . . . (5-13)
  - Oscilloscope waveforms *4-2
  - Removing SMO subassemblies . . . . 5-3a(3)(e)
  - Removing the remaining modules . . 5-3a(3)(d)
  - Replacement of converter oscillator modules . . . . 5-3a(3)(h)
  - Replacing front panel . . . . 5-3a(3)(g)
  - Replacing SMO subassemblies . . . . 5-3a(3)(f)
  - R-f tuner Module Removal . . . . . 5-3a(3)(c)
  - SMO Module Removal . . . . 5-3a(3)(b)
  - Test equipment for functional testing of CV-731/URC *4-5
  - Trouble isolation to module *4-1
  - Unit removal . . . . 5-3a(3)(a)
  - Unit replacement . . . . 5-3a(3)(i)
- CW and FSK operation . . . . 3-5b(1)(b)
- CW break in adjustment . . . . 3-5b(2)
- CW keying release time adjustment . . . 2-6b(3)
- CW operation . . . . 3-2b(6)

D

- Description of operating control and indicators for Radio Set AN/URC-32A *3-1
- Description of Units:
  - Amplifier-Control AM-2062( )/URC . 1-3f, (1-6)
  - Amplifier-Converter-Modulator AM-2064/URC 1-3d, (1-4)
  - Control-Power Supply C-2691/URC . 1-3h, (1-8)
  - Converter-Monitor CV-730/URC . . 1-3e, (1-5)
  - Converter-Oscillator CV-731/URC . 1-3c, (1-3)
  - Electrical Dummy Load DA-218/U . . 1-3l, (1-13)
  - Electronic Equipment Air Cooler HD-347/U 1-3j, (1-11)
  - Interconnecting Box J-1007/U 1-3a
  - Power Supply PP-2153/U 1-3k, (1-12)
  - Power Supply PP-2154/U 1-3i, (1-10)

Paragraph (Figure) *Table

D (Cont)

- Description of Units: (Cont)
  - Radio Frequency Amplifier AM-2061/URT 1-3b, (1-2)
  - Signal Comparator CM-126/UR . . . 1-3g, (1-7)
- Discriminator tuned circuits, frequency versus reactance curves . . (4-16)
- Drive tuning calibration curve for AM-2061/URT . . . . (4-7)
- Dynamic Handset H-169/U:
  - Detailed circuit description . . . . . 4-3i(2)
  - Functional description 4-3i
  - Functional test data . . . . 4-3i(1)
  - Photograph . . . . (1-9)
  - Schematic Diagram 5-126

E

- Electronic Equipment Air Cooler HD-347/U:
  - Air filter cleaning procedure . . . . 5-3a(11)(b)
  - Lubrication . . . . 5-3a(11)(c)
  - Rack Mounting . . . . (2-1)
  - Removal . . . . 5-3a(11)(a)
  - Replacement . . . . 5-3a(11)(d)
  - Schematic Diagram . . . . (5-127)
- Emergency maintenance 3-5d
- Emergency maintenance 5-3b
- Emergency operation:
  - Damage to CW or FSK functions . . . 3-4a(2)
  - Damage to transmitter section . . . . 3-4a(1)
  - Jamming 3-4b
- Equipment required but not supplied . . . 1-7, *1-5
- Equipment similarities 1-10
- Equipment supplied 1-5, *1-3
- External connections and modifications for alternate use of Radio Set AN/URC-32( ) with Coupler Monitor CU-737/URC and multicoupler. . . . . (5-95)
- External Connections to Antenna Control C-1360( )/SRT (Part of AN/BRA-3) and Antenna Network 180U-2 . . . . (5-93)
- External Connections to Antenna Coupler Group AN/SRA-22 . . . . . . (5-94)
- External Connections to remote control units . . . . (5-92)

F

- Factory Changes 1-8, *1-6
- Failure Analysis 4-1f
- Failure, performance and operational reports 5-1
- Field Changes 1-9, *1-7

INDEX (Cont)

Paragraph (Figure) *Table

F (Cont)

Four-kilocycle spectrum generator alignment . . . 5-2b(2)(e)5
Frequency Accuracy Check or Reference Oscillator and SMO . . . 4-4e
Frequency calibration check of Radio Set AN/URC-32 series . . . 3-5b(4)
Frequency Discriminator, response curve derivation . . . (4-12)
FSK Frequency Adjustment . . . 5-2b(4)(b)
Functional block diagrams (see block diagrams)
Functional description, overall . . . 4-2
Functional operation . . . 3-2
Functional section descriptions . . . 4-3
  Amplifier-Control AM-2062( )/URC . . . 4-3f
  Amplifier-Converter-Modulator AM-2064/URC . . . 4-3d
  Control Power Supply . . . 4-3h
  Converter-Monitor CV-730/URC . . . 4-3e
  Converter-Oscillator CV-731/URC . . . 4-3c
  Dynamic Handset H-169/U . . . 4-3i
  Electronic Equipment Air Cooler HD-347/U . . . 4-3k
  Interconnecting Box J-1007/U . . . 4-3a
  Power Supply PP-2153/U . . . 4-3l
  Power Supply PP-2154/U . . . 4-3j
  Radio Frequency Amplifier AM-2061/URT . . . 4-3b
  Signal Comparator CM-126/UR . . . 4-3g

G

General description of equipment . . . 1-2

I

I-f mixers subassembly alignment (Model A and Model B SMO) . . . 5-2b(2)(e)3
I-f mixer subassembly alignment (Model C SMO) . . . 5-2b(2)(e)4
Independent sideband operation . . . 2-6b(4)
Indicator presentations . . . 3-2c
Initial setting of front panel controls . . . 4-4b
Inspection and adjustment . . . 2-6
Installation:
  Basic . . . (2-5) (2-6)
  Flush mounting . . . (2-7)
  Requirements . . . 2-4
Interconnecting Box J-1007/U:
  Assembly and replacement . . . 5-3a(1)(c)
  Detailed circuit description . . . 4-3a(2)
  Determine over-all performance . . . 4-3a(1)(a)
  Disassembly . . . 5-3a(1)(b)
  Equipment and tools required for functional testing . . . 4-3a(1)(b)

Paragraph (Figure) *Table

I (Cont)

Interconnecting Box J-1007/U: (Cont)
  Functional test data . . . 4-3a(1)
  Interconnecting wiring diagram . . . (5-96)
  Removal . . . 5-3a(1)(a)
Interference reduction . . . 2-7
Isolation amplifier module alignment . . . 5-2b(2)(f)

J

Jamming . . . 3-4b

L

Line input gain adjustments for simultaneous USB and LSB transmit operation . . . 2-6c(4)(c)
Line input gain adjustments for USB or LSB transmit operation . . . 2-6b(4)(b)
Line Level adjustment . . . 5-2b(5)(a)
List of units . . . 6-2
Logical trouble shooting . . . 4-1
Low voltage measurements . . . 4-4d
LSB and USB audio gain adjustment . . . 5-2b(3)(h)
LSB I-F/A-F amplifier module alignment . . . 5-2b(3)(d)

M

Maintenance Kit . . . 5-2a
Maintenance parts list . . . *6-2, 6-3
Maintenance standards . . . 5-2a
Manufacturers, list of . . . *6-3, 6-4
Meter balance adjustment . . . 5-2b(3)(g)
Meter Readings . . . 3-5a(1)
Mike and line amplifier module gain adjustment . . . 5-2b(5)(c)

N

Neutralization adjustment . . . 5-2b(1)(b)
Neutralizing circuit for AM-2061/URT . . . (4-8)
Nomenclature cross reference list . . . *1-1
Normal meter readings on Radio Set AN/URC-32A during transmit operation . . . (3-4)

O

Operating adjustments . . . 3-5b
Operating checks . . . 3-5a
Operating controls . . . *3-1, 3-2a
Operating controls and indicators . . . (3-1)
Operating procedures . . . 3-2
Operating procedures summary . . . *3-6
Operators maintenance . . . 3-5

INDEX (Cont)

Paragraph
(Figure)
*Table

O (Cont)

Operators trouble shooting procedure . . . *3-5
Over-all functional block diagram . . . (4-1)

P

Power amplifier filament voltage check . . . 5-2b(1)(e)
Power amplifier tube balance . . . 5-2b(1)(c)
Power requirements . . . 2-2
Power Supply PP-2153/U
  Detailed circuit description . . . 4-31(2)
  Determining over-all performance . . . 4-31(1)(a)
  Equipment required for functional testing . . . 4-31(1)(b)
  Functional test data . . . 4-31(1)
  Removal . . . 5-3a(8)(a)
  Replacement . . . 5-3a(8)(b)
  Schematic Diagram . . . (5-123)
Power Supply PP-2154/U
  Detailed circuit description . . . 4-3j(2)
  Determining over-all performance . . . 4-3j(1)(a)
  Equipment required for functional testing . . . 4-3j(1)(b)
  Functional test data . . . 4-3j(1)
  Removal . . . 5-3a(10)(a)
  Replacement . . . 5-3a(10)(b)
Power turn-on . . . 2-6a
Preparation for reshipment . . . 1-11
Preventative maintenance . . . 5-2
Preliminary power connection . . . 2-4i
Primary Power Distribution . . . 5-89
Procedure for simple repair . . . 3-5d(1)

R

Radio Frequency Amplifier AM-2061/URT . . . 5-3a(2)
  ALC circuit . . . 4-3b(2)(d)
  Alignment test setup . . . (5-100)
  Assembly and replacement . . . 5-3a(2)(c)
  Bias and filament circuits . . . 4-3b(2)(e)
  Detailed circuit description . . . 4-3b(2)
  Determining over-all performance . . . 4-3b(1)(a)
  Disassembly . . . 5-3a(2)(b)
  Driver stage . . . 4-3b(2)(a)
  Equipment and tools required for functional testing . . . 4-3b(1)(b)
  Functional test data . . . 4-3b(1)
  Plate 1 and Plate 2 balance . . . 4-3b(1)(a)2
  Removal . . . 5-3a(2)(a)
  Schematic Diagram MCN No. 1833 and below . . . (5-98)
  Schematic Diagram MCN No. 1834 and above . . . (5-99)

Paragraph
(Figure)
*Table

R (Cont)

Radio Frequency Amplifier AM-2061/URC (Cont)
  Switch and interlock circuits . . . 4-3b(2)(g)
  TGC circuit . . . 4-3b(2)(c)
  Time-delay circuits . . . 4-3b(1)(a)1
Receive line output gain adjustments . . . 2-6b(4)(a)
Receiver gain adjustment . . . 2-6b(1)
Receiver sensitivity check . . . 4-4k
Receiver tuning . . . 3-2d(1)
Reference data . . . 1-4
Reference I-f Amplifier Subassembly Alignment . . . 5-2b(2)(e)6
Reference Oscillator Module Alignment . . . 5-2b(2)(b)
Removal, repair, and replacement of parts modules and units . . . 5-3a
Repair . . . 5-3
R-f and I-f circuit alignment, receive function . . . 5-2b(2)(a)2
R-f and I-f circuit alignment function . . . 5-2b(2)(a)1
R-f Tuner:
  Alignment . . . 5-2b(2)(a)
  Gain check . . . 4-4h
  Subassembly alignment . . . 5-2b(2)(e)2

S

Schematic diagrams and test data (also see listing under individual units) . . . 5-4
Scope . . . 1-1
Selecting operating frequency . . . 3-2b(3)
Sequence of operation . . . 3-2b
Sidestep oscillator:
  Alignment . . . 5-2b(2)(c)
  Operating check . . . 4-4i
Signal Comparator CM-126/UR:
  Adjustment and Alignments . . . 4-3g(1)(c)
  Detailed Circuit description . . . 4-3g(2)
  Determining over-all performance . . . 4-3g(1)(a)
  Equipment required for functional testing . . . 4-3g(1)(b)
  Functional test data . . . 4-3g(1)
  Operating procedures using 100-kc external frequency standard . . . 4-3g(1)(a)1
  Operating procedures using a transmitted frequency standard . . . 4-3g(1)(a)2
  Removal . . . 5-3a(7)(a)
  Replacement . . . 5-3a(7)(b)
Similarity with Transceiver KWT-6 Type 8 . . . 1-10c
Signal I-f Amplifier Subassembly Alignment (Model B and C SMO) . . . 5-2b(2)(e)8
Signal I-f Amplifier Subassembly Alignment (Model A SMO) . . . 5-2b(2)(e)7

INDEX (Cont)

Paragraph (Figure) *Table

S (Cont)

Site selection 2-3
Speaker amplifier module gain adjustment . . . . 5-2b(5)(b)
Stabilized Master Oscillator:
  Alignment . . . . 5-2b(2)(e)
  Check . . . . 3-5a(2)
Summary of operating procedures 3-3
Symptom elaboration 4-1b
Symptom recognition 4-1a

T

Teletypewriter FSK Operation . . . . . 3-2b(5)
TGC amplifier alignment . . . . 5-2b(3)(i)
Transmit audio level adjustments . . . . 3-5b(1)
Transmit circuit:
  Functional Block Diagram . . . . . . (4-2)
  Schematic diagram . . . . (5-90)
Transmit operation check 4-4j
Transmit tuning . . . . 3-2d(2)
Tuning procedure and adjustments . . . 3-2d
Turning on equipment . . . . 3-2b(1)

T (Cont)

Twenty Kilocycle Divider:
  Base Voltage Waveforms . . . . . . (4-20)
  Simplified Schematic Diagram . . . . (4-19)
Typical application of module tray and extension cable . . . . (5-2)
Typical application of SMO subassembly extension board . . . . . (5-3)

U

Unpacking and handling 2-1
USB I-f/A-f Amplifier Module Alignment . . . . 5-2b(3)(c)

V

Voice operation . . . . 3-2b(4)

0.1 Kc Tuning Module Alignment . . . . 5-2b(2)(d)
115-Volt, 2-Wire Operation . . . . . . 2-4i(1)
230-Volt, 2-Wire Operation . . . . . . 2-4i(3)
230-Volt, 3-Wire Operation . . . . . . 2-4i(2)

NAVSHIPS NO.________ USER ACTIVITY COMMENT SHEET Vol. No.________

(Fold on dotted lines on reverse side,
staple in corner, and send to Bureau
of Ships, Code 240, Washington 25, D.C.)

PROBLEM AREA:

Fold

DEPARTMENT OF THE NAVY
BUREAU OF SHIPS
WASHINGTON 25, D.C.

OFFICIAL BUSINESS

POSTAGE AND FEES PAID
NAVY DEPARTMENT

CHIEF, BUREAU OF SHIPS
PUBLICATIONS AND INFORMATION RETRIEVAL BRANCH
DEPARTMENT OF THE NAVY
WASHINGTON 25, D.C.

Fold

SUPPLEMENT 1

to

TECHNICAL MANUAL NAVSHIPS 93285(B)

for

RADIO SET AN/URC-32

When used with

TRANSMITTER GROUP AN/WRA-3

as Exciter

Manufactured by
HOFFMAN ELECTRONICS CORPORATION
MILITARY PRODUCTS DIVISION
EL MONTE, CALIFORNIA

DEPARTMENT OF THE NAVY
BUREAU OF SHIPS

CONTRACT NObsr 91345
NS 0280 506 4032

25 March 1965

1. GENERAL INFORMATION.

Transmitter-Transfer Control C-6562/WRA-3 (figure 1) adapts Radio Set AN/URC-32 r operation at an average power output of 500 watts while receiving rf drive from Trans- itter Group AN/WRA-3. These instructions are applicable only to those radio sets ich have been modified according to Field Change Bulletin NAVSHIPS 0285 075 5000.

1. INSTALLATION.

Transmitter-Transfer Control C-6562/WRA-3 is installed in accordance with the structions contained in Field Change Bulletin NAVSHIPS 0285 075 5000.

1. OPERATOR'S SECTION.

The only control on Transmitter-Transfer Control C-6562/WRA-3 is the TRANSMITTER XCITATION switch 6S1, located on the front panel. When the switch is set to the URC-32 NT) position, Radio Set AN/URC-32 operates independently. Refer to NAVSHIPS 285(B). When the switch is set to the AN/WRA-3 (EXT) position, Radio Set AN/URC-32 ses Transmitter Group AN/WRA-3 as the exciting unit. Refer to NAVSHIPS 0967 031 9010.

1. PRINCIPLES OF OPERATION.

Transmitter-Transfer Control C-6562/WRA-3 couples Transmitter Group AN/WRA-3 Radio Set AN/URC-32, allowing Transmitter Group AN/WRA-3 to be used as the citing unit. See figure 2. When the Transmitter-Transfer Control switch is set to the N/URC-32 (INT) position, Radio Set AN/URC-32 is disconnected from Transmitter Group N/WRA-3, and operates in a normal manner. The rf output from Transmitter Group N/WRA-3 is then terminated in a 47 ohm load resistor.

When the transmitter-transfer control switch is set to the WRA-3 (EXT) position, the emote key line of Radio Set AN/URC-32 is disconnected through the transmitter-transfer ontrol, and remote control is removed from all other stations. When the switch is in this osition, keying for Radio Set AN/URC-32 is accomplished only at Transmitter Group N/WRA-3 through the transmitter-transfer control and connector 6J1. The rf output of ransmitter Group AN/WRA-3 is fed to Radio Set AN/URC-32 via connectors 6J2 and 6J3 the transmitter-transfer control. A 10 db attenuator in Transmitter Group AN/WRA-3 nd a 10 db network (consisting of 6R1, 6R2, 6R3, and 6R4) in the transmitter-transfer ontrol reduces the rf drive for Radio Frequency Amplifier AM-2061/URT of Radio Set N/URC-32 from Transmitter Group AN/WRA-3 to a nominal 0.15 watt. This rf drive transferred to Radio Frequency Amplifier AM-2061/URT of Radio Set AN/URC-32 rough a connector of the transmitter-transfer control. In this position the rf output, om Converter-Oscillator CV-731/URC of Radio Set AN/URC-32, fed into the transmitter- ansfer control through connector J4, is now terminated in the 47 ohm load resistor. rive level to Radio Frequency Amplifier AM-2061/URT of Radio Set AN/URC-32 is adjusted at the RF DRIVE control on the front panel of Radio Frequency Amplifier AM-2819/WRA-3 of Transmitter Group AN/WRA-3.

When using the AN/WRA-3 to excite Radio Set AN/URC-32, it is necessary to place the AN/URC-32 EXCITER RF GAIN control on Amplifier-Converter-Modulator AM-2064/URC in the full counterclockwise position. When using Radio Set AN/URC-32 independently, it is necessary to place the AN/WRA-3 RF DRIVE control on AM-2819/WRA-3 in the full counterclockwise position, and the AN/WRA-3 must be placed in standby mode or it may be completely deenergized, if desired.

In Interconnecting Box J-1007/U of Radio Set AN/URC-32, the existing lead to TBG-8 (spare wire to pin 8 of J8 of Amplifier Control AM-2062A/URC of Radio Set AN/URC-32) is removed from TBG-8 by Field Change Bulletin NAVSHIPS 0285 075 5000. The connection for remote key line of Radio Set AN/URC-32 is transferred from TBF-8 to TBG-8 of Radio Set AN/URC-32, Interconnecting Box J-1007/U by Field Change Bulletin NAVSHIPS 0285 075 5000.

5-1. TROUBLESHOOTING.

No special troubleshooting procedures have been prepared for Transmitter-Transfer Control C-6562/WRA-3. Because of its simplicity, malfunctions may be localized quickly with reference to the schematic diagram, figure 2.

6-1. REPAIR.

No repair instructions are required for Transmitter-Transfer Control C-6562/WRA-3. Replacement parts are listed in table 7-1.

7-1. PARTS LIST.

Table 7-1 lists the maintenance parts of Transmitter-Transfer Control C-6562/WRA-3. These parts appear on the schematic diagram, figure 2. Table 7-2 lists those maintenance parts which were added to Radio Set AN/URC-32 by Field Change Bulletin NAVSHIPS 0285 075 5000. These parts also appear on the schematic diagram, figure 2.

TABLE 7-1. PARTS LIST

ransmitter-Transfer Control C-6562/WRA-3

REF DESIG	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
J1		CONNECTOR, RECEPTACLE, ELECTRICAL: MIL-C-5015 type MS3102R-18-1P	Keying input Figures 1 & 2
J2		CONNECTOR, RECEPTACLE, ELECTRICAL: BNC type, MS27035-625B per MIL-C-3608	Rf input from Transmitter Group AN/WRA-3 Figures 1 & 2
J3		Same as J2	Rf output to Radio Set AN/URC-32 Figures 1 & 2
J4		Same as J2	Rf input from Radio Set AN/URC-32 Figures 1 & 2
R1		RESISTOR, FIXED, COMPOSITION: RC42GF221K; 220 ohms ±10%, 2 w; MIL-R-11	P/o 10 db pad Figure 2
R2		Same as R1	P/o 10 db pad Figure 2
R3		RESISTOR, FIXED, COMPOSITION: RC42GF680K; 68 ohms ±10%, 2 w; MIL-R-11	P/o 10 db pad Figure 2
R4		RESISTOR, FIXED, COMPOSITION: RC42GF101K; 100 ohms ±10%, 2 w; MIL-R-11	P/o 10 db pad Figure 2
R5		RESISTOR, FIXED, COMPOSITION: RC42GF470K: 47 ohms ±10%, 2 w; MIL-R-11	P/o 10 db pad Figure 2
S1A		SWITCH, ROTARY: 2 pole, 2 position; HMPD part/dwg 8050001679	URC-32 or WRA-3 selector switch Figures 1 & 2
S1B		SWITCH, ROTARY WAFER: HMPD part/dwg 8180000150	R. F. DRIVE switch actuated by S1A Figures 1 & 2

TABLE 7-2. PARTS LIST (Continued)

Field Change Bulletin NAVSHIPS 0285 075 5000

REF DESIG	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
P1		CONNECTOR, PLUG, ELECTRICAL: 10-109618-IS per BuShips dwg RE490769	Keying input
P2		CONNECTOR, PLUG, ELECTRICAL: MS35168-88E per MIL-C-3608	P/o W2, Rf input from AN/WRA-3
P3		Same as P2	P/o W4, Rf output to AN/URC-32
P4		Same as P2	P/o W3, Rf input from AN/URC-32
P5		Same as P2	P/o W2, Rf output from AN/WRA-3
P6		Same as P2	P/o W4, Rf input to AN/URC-32
P7		Same as P2	P/o W3, Rf output from AN/URC-32

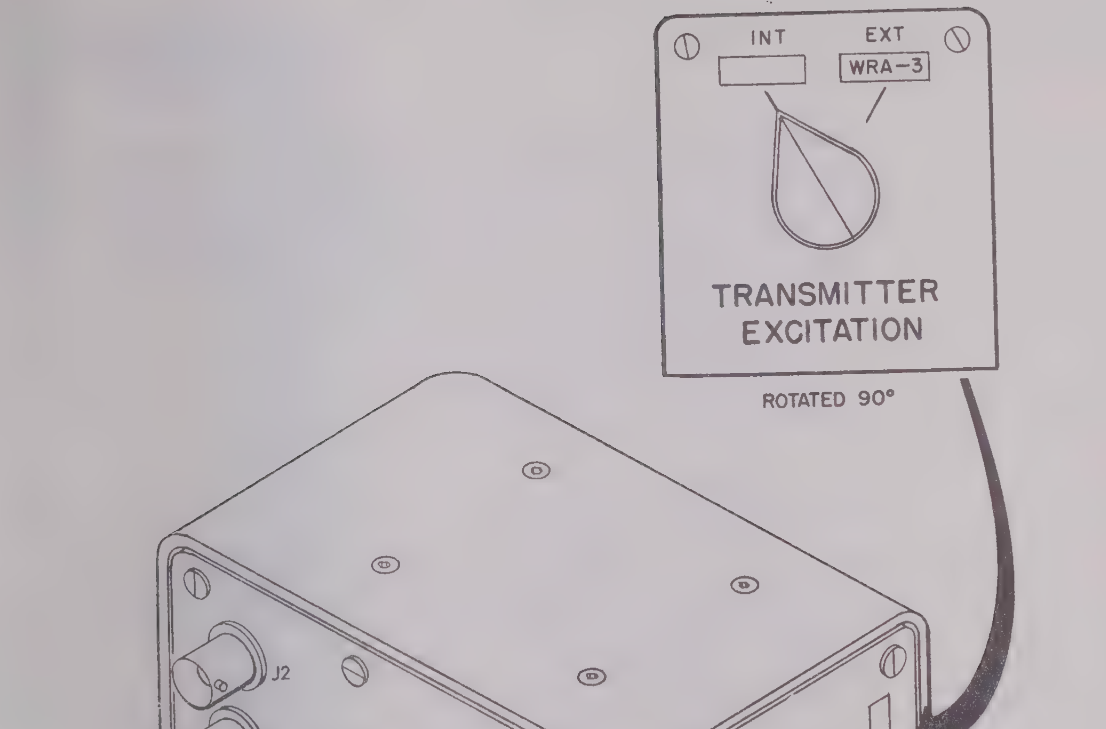
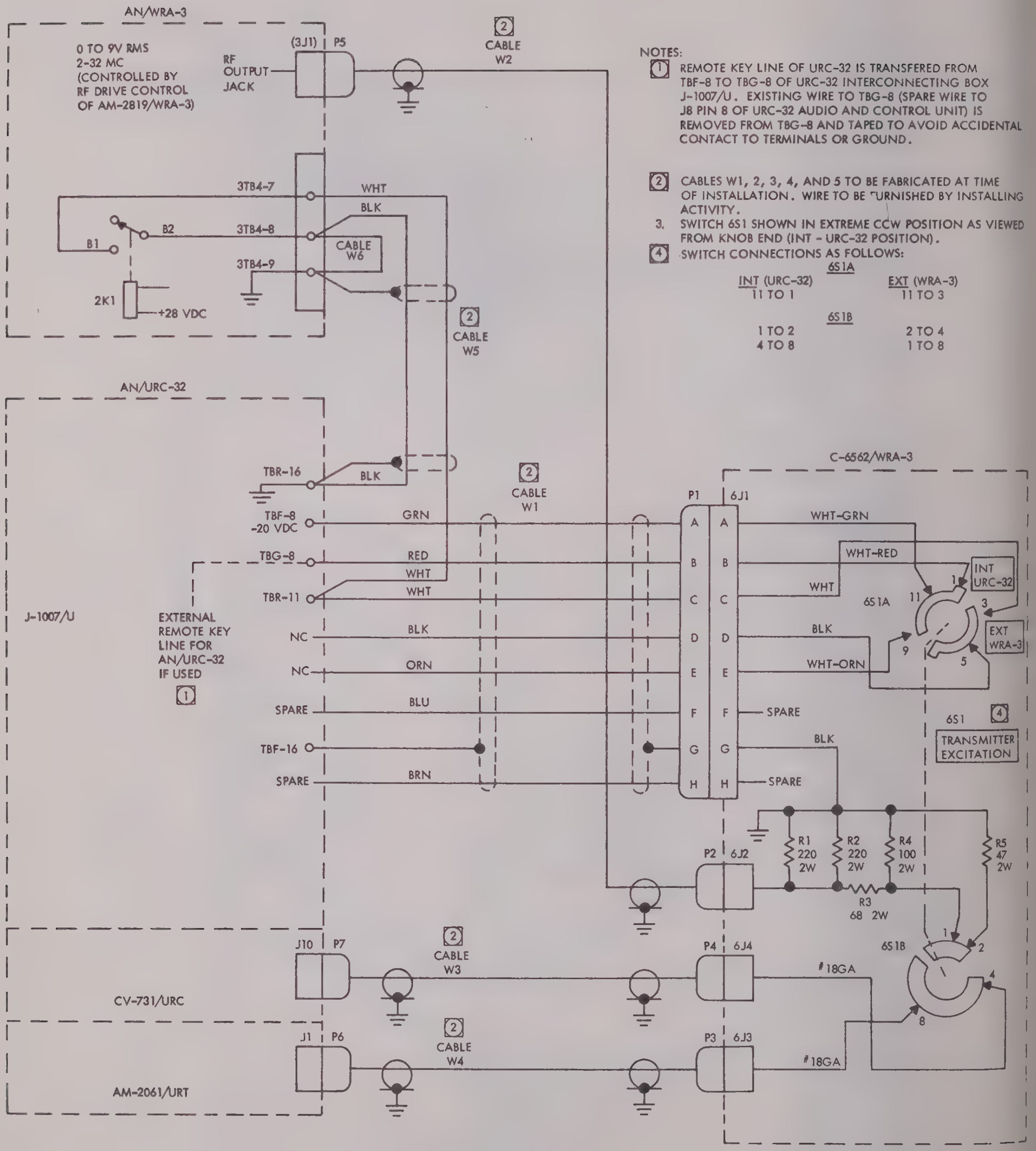

INT
EXT
WRA-3
TRANSMITTER
EXCITATION
ROTATED 90°
J2
J3
J4
J1

Figure 1. Transmitter-Transfer Control C-6562/WRA-3


AN/WRA-3
0 TO 9V RMS
2-32 MC
(CONTROLLED BY
RF DRIVE CONTROL
OF AM-2819/WRA-3)
RF
OUTPUT
JACK
(3J1)
P5
② CABLE W2
3TB4-7
3TB4-8
3TB4-9
B1
B2
2K1
+28 VDC
WHT
BLK
CABLE W6
② CABLE W5
AN/URC-32
TBR-16
BLK
② CABLE W1
TBF-8
-20 VDC
GRN
TBG-8
RED
WHT
WHT
TBR-11
J-1007/U
EXTERNAL
REMOTE KEY
LINE FOR
AN/URC-32
IF USED
①
NC
BLK
NC
ORN
SPARE
BLU
TBF-16
SPARE
BRN
C-6562/WRA-3
P1
6J1
A
B
C
D
E
F
G
H
WHT-GRN
WHT-RED
WHT
BLK
WHT-ORN
SPARE
BLK
SPARE
6S1A
INT URC-32
EXT WRA-3
1
3
5
9
11
6S1 ④
TRANSMITTER
EXCITATION
R1 220 2W
R2 220 2W
R4 100 2W
R5 47 2W
R3 68 2W
P2
6J2
J10
P7
② CABLE W3
P4
6J4
#18GA
CV-731/URC
6S1B
1
2
4
8
J1
P6
② CABLE W4
P3
6J3
#18GA
AM-2061/URT

NOTES:

① REMOTE KEY LINE OF URC-32 IS TRANSFERED FROM TBF-8 TO TBG-8 OF URC-32 INTERCONNECTING BOX J-1007/U. EXISTING WIRE TO TBG-8 (SPARE WIRE TO J8 PIN 8 OF URC-32 AUDIO AND CONTROL UNIT) IS REMOVED FROM TBG-8 AND TAPED TO AVOID ACCIDENTAL CONTACT TO TERMINALS OR GROUND.

② CABLES W1, 2, 3, 4, AND 5 TO BE FABRICATED AT TIME OF INSTALLATION. WIRE TO BE FURNISHED BY INSTALLING ACTIVITY.

3. SWITCH 6S1 SHOWN IN EXTREME CCW POSITION AS VIEWED FROM KNOB END (INT - URC-32 POSITION).

④ SWITCH CONNECTIONS AS FOLLOWS:

INT (URC-32)	EXT (WRA-3)
6S1A	
11 TO 1	11 TO 3
6S1B	
1 TO 2	2 TO 4
4 TO 8	1 TO 8

657-10

Figure 2. Schematic/Interconnecting Diagram for AN/URC-32

TABLE 6-2. (Continued)

CONVERTER-OSCILLATOR, CV-731/URC

REF DESIG	NOTES	NAME AND DESCRIPTION	FIG. NO.
3A5R16		RESISTOR, FIXED, COMPOSITION: same as 3A5R14	5-12
3A5R17		RESISTOR, FIXED, COMPOSITION: MIL type RC20GF102K	5-12
3A5R18		RESISTOR, FIXED, COMPOSITION: same as 3A5R3	5-12
3A5R19		RESISTOR, FIXED, COMPOSITION: MIL type RC20GF104K	5-12
3A5R20		RESISTOR, FIXED, COMPOSITION: MIL type RC20GF103K	5-20
3A5R21		RESISTOR, FIXED, COMPOSITION: MIL type RC20GF272K	5-20
3A5R22		RESISTOR, FIXED, COMPOSITION: MIL type RC20GF562K	5-20
3A5R23		RESISTOR, FIXED, COMPOSITION: same as 3A5R3	5-12
3A5R24		RESISTOR, FIXED, COMPOSITION: same as 3A5R14	5-12
3A5R25		RESISTOR, FIXED, COMPOSITION: same as 3A5R17	5-12
3A5R26		RESISTOR, FIXED, COMPOSITION: same as 3A5R3	5-12
3A5R27		RESISTOR, FIXED, COMPOSITION: same as 3A5R19	5-12
3A5R28		RESISTOR, FIXED, COMPOSITION: MIL type RC20GF472J	5-12
3A5R29		RESISTOR, FIXED, WIREWOUND: 7500 ohms ±3%, 5 w; mfr code 91637, part no. RSM5-75000G	5-12
3A5R30		RESISTOR, FIXED, COMPOSITION: MIL type RC20GF102J	5-12
3A5R31		RESISTOR, FIXED, COMPOSITION: same as 3A5R3	5-12
3A5R32		RESISTOR, FIXED, COMPOSITION: same as 3A5R19	5-12
3A5R33		RESISTOR, FIXED, COMPOSITION: same as 3A5R3	5-12
3A5R34		RESISTOR, FIXED, COMPOSITION: MIL type RC20GF224K	5-12
3A5R35		RESISTOR, FIXED, COMPOSITION: same as 3A5R3	5-12
3A5R36		RESISTOR, FIXED, COMPOSITION: MIL type RC20GF183K	5-12
3A5R37		RESISTOR, FIXED, COMPOSITION: MIL type RC20GF222K	5-12
3A5R38		RESISTOR, FIXED, COMPOSITION: same as 3A5R20	5-12
3A5R39		RESISTOR, FIXED, COMPOSITION: same as 3A5R17	5-12
3A5R40		RESISTOR, FIXED, COMPOSITION: same as 3A5R37	
3A5T1		TRANSFORMER, AUDIO FREQUENCY: plate coupling type; 250 ohms, 80 ma dc, primary; 500 ohms, CT, secondary; 1 w max output; 5 kc frequency; mfr code 95088, part no. TS3700	5-20
3A5T2		TRANSFORMER, AUDIO FREQUENCY: input type; 25 v ac, 20 ma dc primary; 5 v ac, 10 ma dc secondary; 5 kc frequency; mfr code 88063, part no. 94-0532-00	5-20
3A5T3		TRANSFORMER, AUDIO FREQUENCY: plate coupling type; 125 ohms, CT, 100 ma dc primary; 50 ohms, TC, secondary; 10 w max output; 5 kc frequency; mfr code 95088, part no. TS3701	5-20
3A5Y1		CRYSTAL UNIT, QUARTZ: 1 plate, 3.000 kc (p/o 3A5HR1); mfr code 13499, part no. 290-5430-00	5-20
3A5Z1		REFERENCE SIGNAL GENERATOR SUBASSEMBLY: c/o 1 inductor, 9 transistors, 1 circuit board and hardware; mfr code 13499, part no. 544-5646-003	
3A5Z2		OVEN, CRYSTAL: 80°C ±0.1°C; mfr code 13499, part no. 542-7288-002	
3A6		TUNING UNIT, RADIO FREQUENCY 0.1 KC CV-1749( )/UR: mfr code 13499, part no. 528-0397-00	
3A6C1		CAPACITOR, FIXED, ELECTROLYTIC: 4.7 uf, ±20%, 35 vdc; mfr code 56289, part no. 150D475X003582	5-48
3A6C2		CAPACITOR, FIXED, ELECTROLYTIC: same as 3A6C1	5-48
3A6C3		CAPACITOR, FIXED, DIELECTRIC: 160 uuf, CM05F161J03	5-48
3A6C4		CAPACITOR, FIXED, ELECTROLYTIC: same as 3A6C1	5-48
3A6C5		CAPACITOR, FIXED, ELECTROLYTIC: same as 3A6C1	5-48
3A6C6		CAPACITOR, FIXED, DIELECTRIC: 560 uuf, CM06F561J03	5-48
3A6C7		CAPACITOR, FIXED, DIELECTRIC: 220 uuf, CM05F221J03	5-47
3A6C8		CAPACITOR, FIXED, DIELECTRIC: same as 3A6C6	5-48

TABLE 6-2. (Continued)

CONVERTER-OSCILLATOR, CV-731/URC

REF DESIG	NOTES	NAME AND DESCRIPTION	FIG. NO.
3A6C9		CAPACITOR, FIXED, DIELECTRIC: 18 uuf, 912-2762-00	5-48
3A6C10		CAPACITOR, FIXED, DIELECTRIC: same as 3A6C9	5-48
3A6C11		CAPACITOR, FIXED, ELECTROLYTIC: same as 3A6C1	5-48
3A6C12		CAPACITOR, FIXED, ELECTROLYTIC: same as 3A6C1	5-48
3A6C13		CAPACITOR, FIXED, DIELECTRIC: 680 uuf, CM06F681G03	5-48
3A6C14		CAPACITOR, FIXED, DIELECTRIC: 20 uuf, 912-2765-00	5-48
3A6C15		CAPACITOR, FIXED, DIELECTRIC: 0.05 uf, 913-3885-00	5-48
3A6C16		CAPACITOR, FIXED, DIELECTRIC: 3600 uuf, CM06F362J03	5-47
3A6C17		CAPACITOR, FIXED, DIELECTRIC: 470 uuf, CM05F471J03	5-48
3A6C18		CAPACITOR, FIXED, DIELECTRIC: 1800 uuf, CM06F182J03	5-47
3A6C19		CAPACITOR, FIXED, DIELECTRIC: 820 uuf, 912-2995-00	5-47
3A6C20		CAPACITOR, FIXED, DIELECTRIC: 0.02 uf, 913-4099-00	5-48
3A6C21		CAPACITOR, VARIABLE: 5 to 25 uuf, 917-1073-00	5-48
3A6C22 thru 3A6C29		CAPACITOR, VARIABLE: same as 3A6C21	5-48
3A6C30		CAPACITOR, FIXED, DIELECTRIC: same as 3A6C6	5-47
3A6C31		CAPACITOR, FIXED, ELECTROLYTIC: 0.1 uf -20% +80%, 50 v dc 913-3886-00	5-48
3A6C32		CAPACITOR, FIXED, ELECTROLYTIC: same as 3A6C1	5-47
3A6C33		CAPACITOR, FIXED, DIELECTRIC: same as 3A6C14	5-48
3A6C34		CAPACITOR, FIXED, DIELECTRIC: 100 uuf, CM05F101J03	5-47
3A6C35		CAPACITOR, VARIABLE: same as 3A6C21	5-48
3A6C36		CAPACITOR, FIXED, DIELECTRIC: same as 3A6C18	5-48
3A6C37		CAPACITOR, FIXED, DIELECTRIC: same as 3A6C19	5-48
3A6C38		CAPACITOR, FIXED, DIELECTRIC: same as 3A6C20	5-48
3A6C39		CAPACITOR, FIXED, DIELECTRIC: same as 3A6C6	5-48
3A6C40		CAPACITOR, FIXED, DIELECTRIC: same as 3A6C31	5-48
3A6C41		CAPACITOR, FIXED, DIELECTRIC: same as 3A6C1	5-48
3A6C42		CAPACITOR, FIXED, DIELECTRIC: 27 uuf ±10%, 500 v dc, CM05D270K03	5-48
3A6C43		CAPACITOR, FIXED, DIELECTRIC: same as 3A6C15	5-48
3A6C44		CAPACITOR, FIXED, DIELECTRIC: 3900 uuf, CM06F392J03	5-48
3A6C45		CAPACITOR, FIXED, DIELECTRIC: same as 3A6C15	5-47
3A6C46		CAPACITOR, FIXED, CERAMIC: same as 3A6C15	5-48
3A6C47		CAPACITOR, FIXED, CERAMIC: 0.01 uf -20% +80%, 100 v dc, 913-3680-00	5-48
3A6CR1		SEMICONDUCTOR DEVICE, DIODE: 1N458, 353-0205-00	5-47
3A6CR2		SEMICONDUCTOR DEVICE, DIODE: same as 3A6CR1	5-48
3A6CR3 thru 3A6CR6		SEMICONDUCTOR DEVICE, MATCHED QUAD: four matched silicon diodes, encapsulated; mfr code 07263, part no. FA4000	5-48
3A6CR7 thru 3A6CR10		SEMICONDUCTOR DEVICE, MATCHED QUAD: same as 3A6CR3 thru 3A6CR6	5-48
3A6CR11		SEMICONDUCTOR DEVICE, DIODE: same as 3A6CR1	5-47
3A6CR12		SEMICONDUCTOR DEVICE, DIODE: same as 3A6CR1	5-48
3A6FL1		FILTER: 300 kc, 241-0497-00	5-47
3A6K1		RELAY, MAGNETIC-REED: 1A contact arrangement, 26.5 v nom coil voltage; mfr code 24446, part no. 3SBD/001A1	5-46

TABLE 6-2. (Continued)

CONVERTER-OSCILLATOR, CV-731/URC

REF DESIG	NOTES	NAME AND DESCRIPTION	FIG. NO.
3A6L1		INDUCTANCE, STANDARD, VARIABLE: 490 uh, 300 kc, 15-44 Litz wire, mfr code 13499, part no. 544-4771-002	5-48
3A6L2		INDUCTANCE, STANDARD, VARIABLE: same as 3A6L1	5-48
3A6L3		COIL, RADIO FREQUENCY: 554-4770-002	5-48
3A6L4		COIL, RADIO FREQUENCY: 27 mh, 240-1924-00	5-48
3A6L5		COIL, RADIO FREQUENCY: same as 3A6L3	5-48
3A6L6		COIL, RADIO FREQUENCY: same as 3A6L4	5-48
3A6L7		INDUCTANCE, STANDARD: 76 uh, 250 kc, 15-44 Litz wire, mfr code 13499, part no. 544-4815-002	5-48
3A6L8		COIL, RADIO FREQUENCY: 15 mh, 240-0685-00	5-48
3A6L9		COIL, RADIO FREQUENCY: same as 3A6L8	5-48
3A6P1		CONNECTOR, RECEPTACLE, ELECTRICAL: 5 #20 male contacts, 5 amps, mfr code 91146, part no. DBM9W4P	5-48
3A6Q1		TRANSISTOR: 2N2189, 352-0412-00	5-48
3A6Q2 thru 3A6Q6		TRANSISTOR: same as 3A6Q1	5-48
3A6Q7		TRANSISTOR: 2N706, 352-0195-00	5-48
3A6R1		RESISTOR, FIXED, FILM: 8250 ohms, RN60B8251F	5-47
3A6R2		RESISTOR, FIXED, COMPOSITION: 330 ohms, RC20GF331K	5-48
3A6R3		RESISTOR, FIXED, COMPOSITION: 3900 ohms, RC20GF392K	5-48
3A6R4		RESISTOR, FIXED, COMPOSITION: 12K, RC20GF123K	5-48
3A6R5		RESISTOR, FIXED, FILM: 14.7K, RN60B1472F	5-47
3A6R6		RESISTOR, FIXED, FILM: 1620 ohms, RN60B1621F	5-47
3A6R7		RESISTOR, FIXED, COMPOSITION: 2200 ohms ±10%, RC20GF222K	5-48
3A6R8		RESISTOR, FIXED, FILM: 2610 ohms, RN60B2610F	5-47
3A6R9		RESISTOR, FIXED, COMPOSITION: 1000 ohms, RC32GF102K	5-48
3A6R10		RESISTOR, FIXED, COMPOSITION: 15K, RC07GF153K	5-47
3A6R11		RESISTOR, FIXED, FILM: same as 3A6R6	5-47
3A6R12		RESISTOR, FIXED, FILM: 38.3K, RN60B3832K	5-47
3A6R13		RESISTOR, FIXED, FILM: same as 3A6R5	5-47
3A6R14		RESISTOR, FIXED, COMPOSITION: 3300 ohms, RC20GF332K	5-48
3A6R15		RESISTOR, FIXED, COMPOSITION: 56K, RC20GF563K	5-48
3A6R16		RESISTOR, FIXED, COMPOSITION: same as 3A6R15	5-47
3A6R17		RESISTOR, FIXED, COMPOSITION: 6800 ohms, RC20GF682K	5-48
3A6R18		RESISTOR, FIXED, COMPOSITION: 10K, RC20GF103K	5-48
3A6R19		RESISTOR, FIXED, COMPOSITION: same as 3A6R18	5-47
3A6R20		RESISTOR, FIXED, COMPOSITION: 4700 ohms ±10%, 1/2 w; RC20GF472K	5-47
3A6R21		RESISTOR, FIXED, COMPOSITION: same as 3A6R14	5-47
3A6R22		RESISTOR, FIXED, COMPOSITION: 56K, RC07GF563K	5-47
3A6R23		RESISTOR, FIXED, COMPOSITION: same as 3A6R22	5-47
3A6R24		RESISTOR, FIXED, COMPOSITION: same as 3A6R17	5-48
3A6R25		RESISTOR, FIXED, COMPOSITION: 10K, RC07GF103K	5-48
3A6R26		RESISTOR, FIXED, COMPOSITION: same as 3A6R25	5-47
3A6R27		RESISTOR, FIXED, COMPOSITION: 3300 ohms, RC07GF332K	5-47
3A6R28		RESISTOR, FIXED, COMPOSITION: same as 3A6R20	5-48
3A6R29		RESISTOR, FIXED, COMPOSITION: 15 ohms, RC07GF150K	5-48

TABLE 6-2. (Continued)

CONVERTER-OSCILLATOR, CV-731/URC

REF DESIG	NOTES	NAME AND DESCRIPTION	FIG. NO.
3A6R30		RESISTOR, FIXED, COMPOSITION: 100 ohms, RC20GF101K	5-48
3A6R31		RESISTOR, FIXED, COMPOSITION: 8200 ohms RC20GF822K	5-48
3A6R32		RESISTOR, FIXED, COMPOSITION: 5600 ohms, RC20GF562K	5-47
3A6R33		RESISTOR, FIXED, COMPOSITION: 220 ohms, RC20GF221K	5-47
3A6R34		RESISTOR, FIXED, COMPOSITION: 4700 ohms, RC07GF472K	5-47
3A6R35		RESISTOR, FIXED, FILM: 1000 ohms, RN60B1000F	5-47
3A6R36		RESISTOR, FIXED, COMPOSITION: 39K, RC20GF393K	5-48
3A6R37		RESISTOR, FIXED, COMPOSITION: 1200 ohms ±10%, 1/2 w; RC20GF122K	5-47
3A6R38		RESISTOR, FIXED, COMPOSITION: same as 3A6R37	5-47
3A6R39		RESISTOR, FIXED, COMPOSITION: same as 3A6R20	5-47
3A6R40		RESISTOR, FIXED, COMPOSITION: same as 3A6R4	5-48
3A6R41		RESISTOR, FIXED, COMPOSITION: 12,000 ohms, 2 watts, MIL type RC42GF123K	5-46
3A6S1		SWITCH, ROTARY: 2 circuit, 10 position; 1 amp at 28 vdc, 1 amp at 115 vac, thumbwheel for manual operation; mfr code 10984, part no. TTS27525	5-48
3A6S2		SWITCH, THERMOSTATIC: spst, 267-0180-00	5-46
3A6T1		TRANSFORMER: 300 kc, 554-4773-002	5-48
3A6T2		TRANSFORMER: 512 kc, 554-4772-002	5-48
3A6T3		TRANSFORMER: same as 3A6T2	5-48
3A6Y1		CRYSTAL UNIT, QUARTZ: 212.100 kc, mfr code 75378, part no. 290-0211-00	5-46
3A6Y2		CRYSTAL UNIT, QUARTZ: 212.200 kc, mfr code 75378, part no. 290-0212-00	5-46
3A6Y3		CRYSTAL UNIT, QUARTZ: 212.300 kc, mfr code 75378, part no. 290-0213-00	5-46
3A6Y4		CRYSTAL UNIT, QUARTZ: 212.400 kc, mfr code 75378, part no. 290-0214-00	5-46
3A6Y5		CRYSTAL UNIT, QUARTZ: 212.500 kc, mfr code 75378, part no. 290-0215-00	5-46

☆ U. S. GOVERNMENT PRINTING OFFICE:1969-393-912-S/2469